ROADS and STREETS

HIGHWAYS • BRIDGES • AIR FIELDS • HEAVY CONSTRUCTION

Gillette Publishing Co., 53 West Jackson Blvd., Chicago 10, Illinois

DECEMBER 1955

S. J. GROVES' BIG ROCK JOB

Aerial Engineering Methods

– Ohio Goes "All-Out"

Contents p. 4 – Equipment p. 16

Accepted as Controlled Circulation Publication at Cedar Rapids, Iowa

CARBIDE INSERT? or MULTI-USE?

TIMKEN® carbide insert bits blaze Maine Turnpike trail faster, cheaper

...Reports H. E. Sargent, Inc.

REMOVING rock for the Portland-Augusta Toll Turnpike and furnishing rock to be crushed for use in pavement, H. E. Sargent, Inc., had to drill fast through hard granite to stay on schedule. The firm used Timken® carbide insert bits for the job, and reports Timken bits increased drilling speed, gave better footage life, needed fewer bit changes.

In hard, abrasive ground like this, Timken *carbide insert* bits are most economical, give fastest drilling speeds. This is true also when you're drilling constant-gauge holes, small diameter blast holes, extremely deep holes.

However, where ground is such that full increments of steel can be drilled, Timken *multi-use* bits are most economical. With correct and controlled reconditioning, they give you the lowest cost per foot of hole drilled.

Whichever type of Timken bit you use, you'll be glad to know that the bits are interchangeable in the same thread series. And a wide range of different Timken bits fit the same drill steel. If the ground changes, you can switch bits quickly and easily right on the job.

The Timken Rock Bit Engineering Service can give you the benefit of over 20 years experience in recommending the best bit for the job. May we help you? Write: The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable: "TIMROSCO".

LOCATION: Hallowell, Maine.

OPERATION CONDITIONS: Primary drilling of constant-gauge 4″ blast holes, 30′ deep, in hard granite.

Timken threaded multi-use rock bit

Timken threaded carbide insert rock bit

your best bet for the best bit ... for every job

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

P&H Model 655-B; 1½-yd. capacity. P&H builds the world's most complete line of Power Cranes and Shovels.

P&H ...20 YEARS AHEAD with welded construction!

Think of it! . . . 20 years ago P&H threw out the old patterns to give you a new and better kind of power shovel — *completely welded of rolled alloy steels!*

Twenty successful years in the field have proved beyond all doubt the advantages you gain through greater strength and the elimination of dead weight. Today's P&H machines give you faster cycles, still more dependable service — still lower yardage costs. Behind today's machines is P&H's long experience in welded design and construction — still 20 years ahead of the field.

All-welded construction is only one of many major improvements originated by P&H. There are others that will earn you more money than is possible with older style machines you may now be using. Get the facts from your nearest P&H dealer. P&H Power Crane and Shovel Division, Harnischfeger Corporation, Milwaukee 46, Wis.

HARNISCHFEGER

See your **P&H** *dealer*

"Your P&H Dealer has the experience, the organization and the facilities to serve you reliably in every way. He's ready to deliver the kind of on-the-ground service that keeps your jobs moving on schedule. Your P&H Dealer is tops in the business. Get to know him."

the **P&H** *Line*

TRUCK CRANES · DIESEL ENGINES · POWER SHOVELS · PREFABRICATED HOMES · HOISTS · SOIL STABILIZERS · WELDING EQUIPMENT · OVERHEAD CRANES

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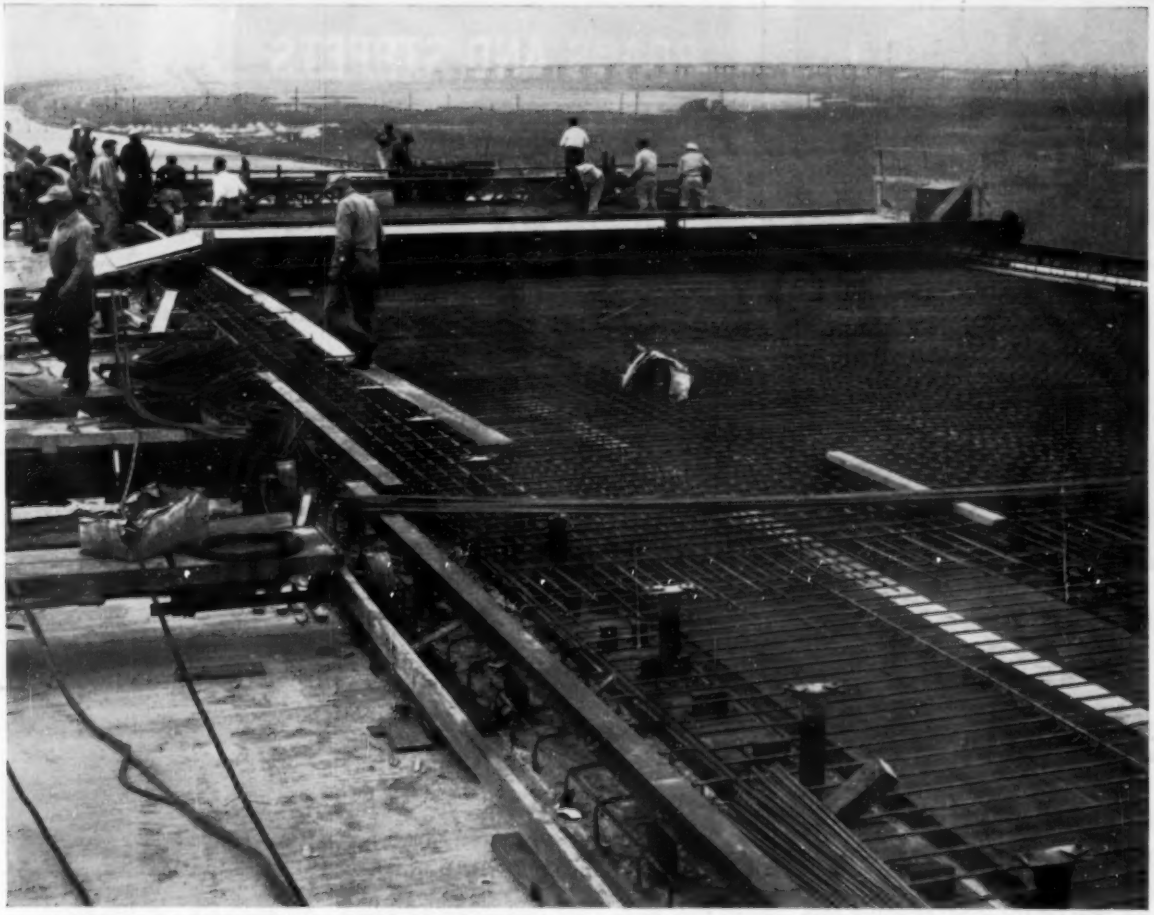

Cayuga Foundation Corp., N.Y.C., paving the west approach to the bridge. With approaches the bridge will contain 25,000 tons of steel. Bethlehem's Fabricated Steel Division erected the superstructure.

Newark Bay Bridge is Expressway Linking N. J. Turnpike and Holland Tube

The $40 million Newark Bay Bridge, now under construction, is the newest link between New York City and the Newark area. The New Jersey Turnpike Authority project is part of eight miles of expressway which will connect the Holland Tunnel with the turnpike at the Newark Airport interchange.

With approaches, the six-lane bridge is 9,500 ft long, stretching from the abutment on the east end to the beam spans of the connecting viaduct on the west. The bridge span will have a vertical clearance of 135 ft above the water at the channel, permitting the passage of large vessels into upper Newark bay.

Two 36-ft roadways separated by a 4-ft center mall will cross the bridge. Shown here is the paving operation on the west approach, for which Bethlehem supplied a substantial tonnage of reinforcing bars.

Bethlehem bars, used on so many important concreting jobs, are made exclusively from new-billet steel of known analysis. They come in size ranges from Numbers 3 to 11, with deformations meeting ASTM Spec. A-305. They are cut to length and bent in our shops, and reach the job bundled and tagged, with bar lists included, ready for instant placing.

TEN BAR FABRICATING SHOPS AT YOUR SERVICE

Boston New York Philadelphia
Johnstown, Pa. Baltimore
Buffalo Detroit
Chicago St. Paul Seattle

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM REINFORCING BARS

BETHLEHEM STEEL

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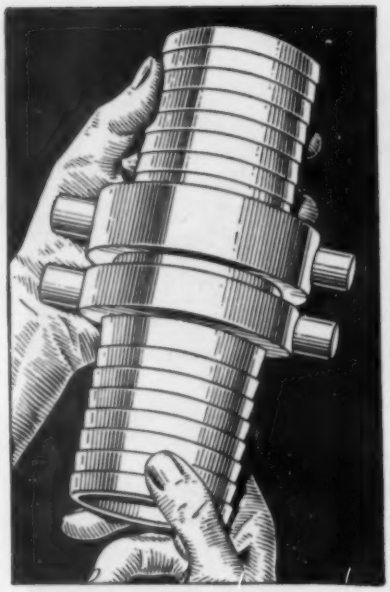

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Shank Coupling

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The "KING" is a brute for punishment, yet thoroughly refined in every detail of manufacture . . . absolute uniformity in quality, dimensions and threading . . . well defined, smoothly finished corrugations. Made in light and heavy patterns, in all-malleable iron, plain or plated; all-brass; and plain or plated malleable iron shanks with brass swivel nut. Size range from 1" to 8", inclusive.

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Sixty-Three Years of Editorial Leadership

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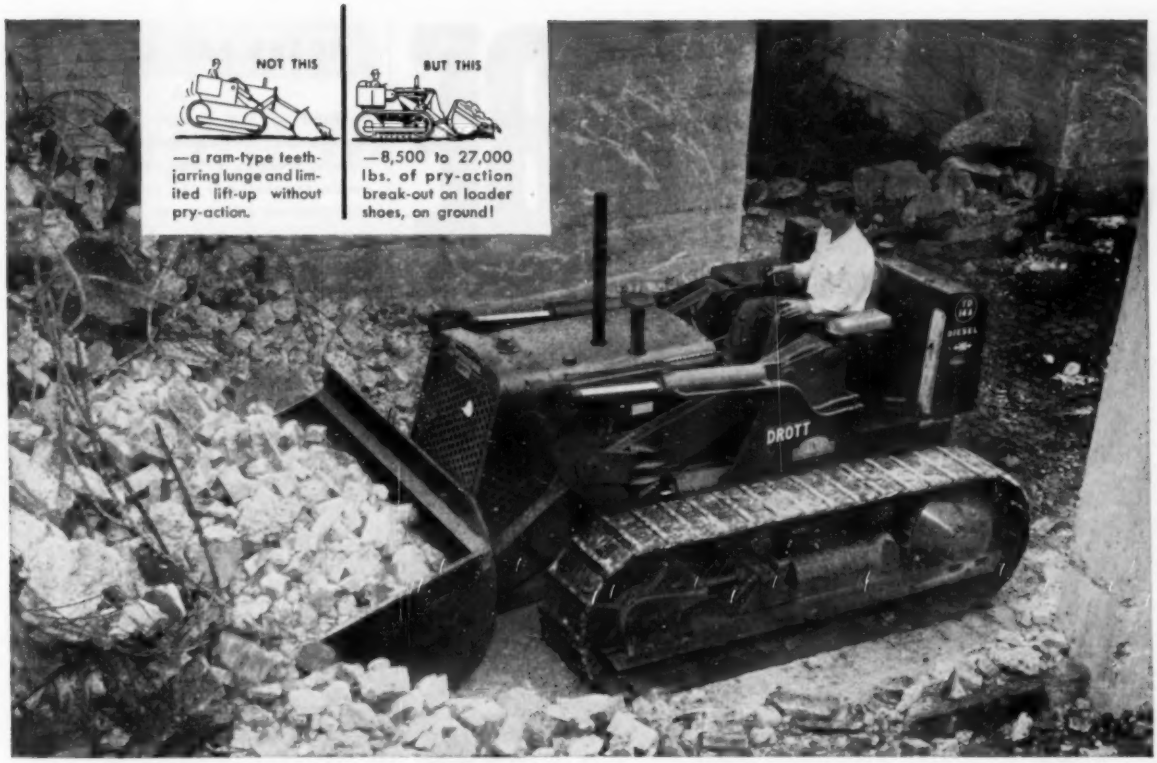
NOT THIS
—a ram-type teeth-jarring lunge and limited lift-up without pry-action.
BUT THIS
—8,500 to 27,000 lbs. of pry-action break-out on loader shoes, on ground!
DROTT

How this exclusive DROTT pry-action break-out

TURNS HARD DIGGING INTO "GRAVY" compared to "shoeless" loaders!

Compare exclusive pry-action break-out capacity!

See for yourself how patented International Drott pry-over-shoe break-out—*plus bucket roll-back*—gives you tremendous *extra* yardage-getting advantages . . . *COMPARE* these Skid-Shovel capacities: Model TD-6K3, 1-yard; break-out force 8,500 lbs. Model TD-9K3, 1½-yard; break-out force 11,500 lbs. Model TD-14K3, 2¼-yard; break-out force 17,000 lbs. Model TD-18K3, 3-yard; break-out force 27,000 lbs.

You can lunge into hard materials with the "shoeless" type of front-end loader—and get shorted with skimpy loads, pass after pass.

Or you can apply the scientific lever principle of patented pry-over-shoe break-out of an International® Drott Skid-Shovel. And you'll get decisively more digging, bucket-heaping power than "shoeless" loaders of comparable size can deliver.

Pry-action's tremendous yardage-getting force breaks compacted or frozen soils—lifts out embedded rocks—yanks up "anchored" materials. Also, this great *hydraulic pry-out power over big skid-shoes* shunts stresses directly into the ground—instead of to bucket, track frames, and final drives!

And only an International Drott has the shock-swallowing protection of Hydro-Spring. This exclusive "impact-cushion" reduces the consequences of shock forces to operator and tractor by 67% or more—besides increasing production and eliminating most hydraulic hose failures! Owners credit this feature, alone, with boosting loader-tractor life a whopping 25 per cent!

Your International Drott distributor invites you to prove with a demonstration how a Skid-Shovel turns hard digging into "gravy"—the bonus yardage way!

INTERNATIONAL HARVESTER

INTERNATIONAL® DROTT

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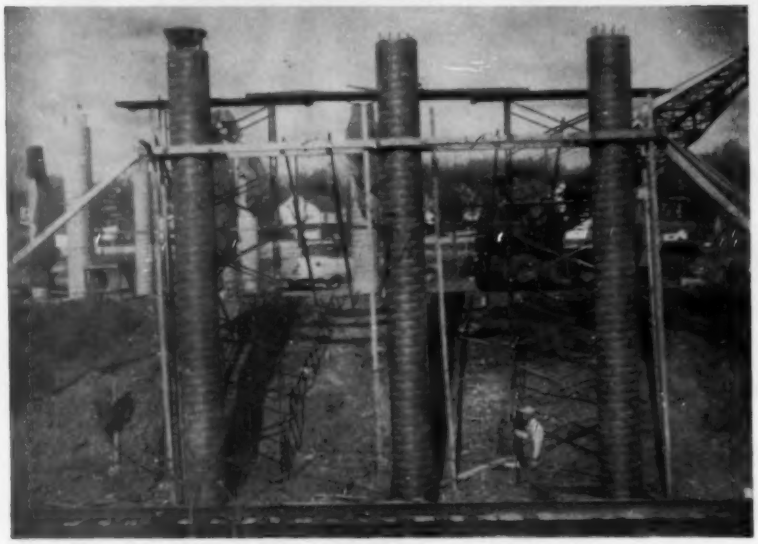
FIBRE FORMS

for round columns of concrete



Railroad and Highway Overpass, near Kansas City, Kansas. State Highway Commission of Kansas, Bridge Department, designers L. G. Barcus & Sons, Contractors.

Round column piers save money!

. . . low cost SONOTUBES® make it possible

This railroad and highway overpass, designed by the Bridge Dept., State Highway Commission of Kansas is supported entirely by round columns of concrete formed by low cost SONOTUBES. Another Sonoco product, SONOVOID, was used in the construction of the bridge deck.

SONOTUBE Fibre Forms are particularly well suited for use with elevated structures of all types because they can be sawed to specific lengths on the job to fit the profile of the ground surface. SONOTUBES save time, labor and money . . . require minimum bracing.

Low cost SONOTUBES are available in 26 sizes, from 2" to 36" I. D. up to 50' long.

Use Sonoco's patented "A-coated" Sonotubes for finished columns; wax coated also available.

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ROADS AND STREETS

Devoted to the design, construction, maintenance and operation of highways, streets, bridges, bridge foundations and grade separations; the construction and maintenance of airports. Represents 63 years of continuous publishing in the highway field; combined with Engineering and Contracting and Good Roads Magazines, established in 1892.

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The year's biggest truck news is right here on this page!

New INTERNATIONALS!

All-Truck Built to save you the BIG money!

It's here! A great new line of light, medium and heavy-duty INTERNATIONALS from 4,200 to 33,000 lbs. GVW. They're *all truck*, with no passenger car components asked to do a truck job . . . with more features than ever for BIG money savings, in operating and maintenance costs.

These new INTERNATIONALS are powered by a range of 10 gasoline and LPG engines designed specifically for trucks. They give you high power and torque in the normal driving range where you can *use* it—in traffic, heavy going, up hills. And they give you this top performance at wear-reducing, money-saving rpm.

They have smart, functional styling for easy, economical maintenance, even on the roughest truck jobs. They have driver-saving cabs that let drivers work longer without fatigue. First chance you get, see these good-looking, easy-working, BIG money-saving INTERNATIONAL Trucks.

Drive in real comfort! Comfort-angled steering. Hood is low for closeup view ahead. There's "Quiet-ride" acoustic roof lining, draft-free door seals in both standard and optional deluxe cabs, plus a wide choice of solid and two-tone exterior colors. New deluxe cab has additional color-keyed interior, deluxe steering wheel, foam rubber seat, fiber glass insulation, deluxe chrome trim.

INTERNATIONAL HARVESTER COMPANY • CHICAGO

INTERNATIONAL® TRUCKS

Motor Trucks • Crawler Tractors • Industrial Power
McCormick® Farm Equipment and Farmall® Tractors

. . . for more details circle 210, page 16

How Marfak cuts maintenance costs

Better and longer lasting protection — that's why contractors prefer *Texaco Marfak* and why *more than 555 million pounds of it have been sold!*

For chassis lubrication, *Texaco Marfak* is ideal because it won't pound or squeeze out. It stays on the job for extra protection against wear and rust. Parts last longer.

In wheel bearings, *Texaco Marfak Heavy Duty* seals out dirt and moisture — seals itself in. This means extra thousands of miles between scheduled lube jobs, extra long life for bearings, and greater braking safety. No seasonal change required.

For multi-purpose use, the new, lithium-base *Texaco Marfak Heavy Duty Special 2* pumps easily and lubricates effectively even at winter temperatures. It resists water washing and stands up in the

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TEXACO STAR THEATER
starring JIMMY DURANTE
on TV Saturday nights.
METROPOLITAN OPERA radio
broadcasts
Saturday afternoons.

TEXACO

Relocating highway along Columbia River.

severest service. It's especially designed for those who want *just one lubricant* to handle all chassis, wheel bearing, water pump and other lubrication.

Two other Texaco cost-reducers: Texaco Universal Gear Lubricant EP to keep transmissions and differentials running smoothly. *Texaco Track Roll Lubricant* to protect and extend the life of crawler track mechanisms.

Let a Texaco Lubrication Engineer help you simplify and improve your maintenance lubrication. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

Texaco Simplified Lubrication Plan–

Enables you to handle *all* major lubrication with *no more than six* Texaco Lubricants. Cuts lubricant inventory, saves time, money and mistakes. A Texaco Lubrication Engineer will gladly develop a Plan especially to meet your requirements.

Lubricants and Fuels

FOR ALL CONTRACTORS' EQUIPMENT

. . . for more details circle 231, page 16

To the man who's thinking about buying a new truck:

maybe you're missing something...

➢ And what you're missing is more than "maybe," it's for *sure*—if you haven't yet visited your Dodge truck dealer.

➢ Do you want to miss a *rock-bottom price?* Perhaps you haven't realized that Dodge trucks actually cost *less* than you'd pay for corresponding models of most other makes.

➢ Do you want to miss *power* so high it leads the field? Consider this: with engines of 169 to 175 horsepower, Dodge overpowers *every other leading make of truck* in the low- and medium-tonnage fields.

➢ Surely you don't want to miss the many advantages of "*Job-Rated.*" Because all units from engine to rear axle are engineered and matched for a specific job, the Dodge truck you buy is exactly *right* for your business.

➢ You don't want to miss Dodge safety—which includes the biggest wrap-around windshield of any truck on the road, the shortest turning radius. Or Dodge superior cab comfort . . . Forward Look Styling.

➢ In short, you get a whale of a lot more truck for a good deal less money than you think! Stop in and see your Dodge truck dealer right away—don't miss *anything!*

DODGE Job-Rated **TRUCKS**

WITH THE *FORWARD* LOOK ➢

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The New UNIT Model 510 *Challenger* ...as a Trenchoe

DESIGNED with a BACKGROUND of 3/8 YARD EXPERIENCE

Evidence of highest quality engineering and construction includes alloy steels and forgings • anti-friction bearings • modern transmission design with involute splines to add strength and reduce wear • straight-in-line engine mounting with torque converter • trunnion supported tapered drums to eliminate bending stress on drive shafts • easily accessible hydraulic clutches • minimum number of main machinery gears enclosed in one-piece cast gear case • force feed lubrication • self-aligning replaceable hook shoes distribute applied pressure over maximum area • interchangeability of parts simplifies maintenance, cuts costs. All these UNIT advantages mean more profitable operations for you.

Why it's BEST *to* INVEST *in modern* UNIT *models*

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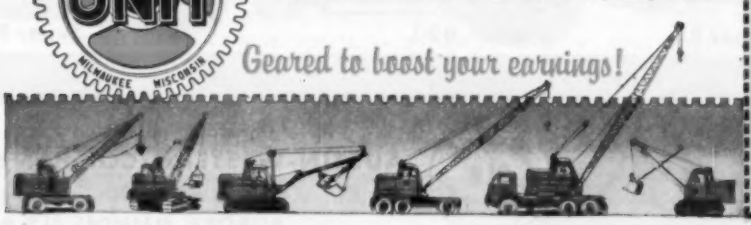

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Milwaukee 14, Wisconsin

Please send me your new Bulletin on the UNIT CHALLENGER Model 510.

Name.....

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You Can Do It Better With an Austin-Western Power Grader

Whatever the job . . . or season . . . or ground condition . . . it's CONTROLLED TRACTION (the exclusive combination of All-Wheel Drive and All-Wheel Steer) that licks 'em all.

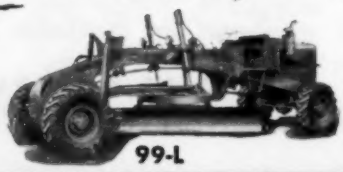
On Austin-Western Power Graders there are no idling front wheels — no dead front end to consume power and decrease efficiency. Every pound is working weight — contributing 100 per cent to traction and delivering maximum power where it counts — at the blade.

Driving, steerable wheels at the rear, teamed up with the live climbing power of Austin-Western's famous front truck, provide flotation and tractive effort ordinary motor graders cannot hope to equal.

Spring and Summer, Fall and Winter, A-W Power Graders outperform all others . . . on all types of work, and under all conditions. Torque Converter Drive — available in all models — makes these . . .

THE HOTTEST MOTOR GRADERS ON WHEELS

NOW THERE ARE FOUR *to meet your every need*



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Power Graders · Motor Sweepers
Road Rollers · Hydraulic Cranes

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Construction Equipment Division

Manufactured by
AUSTIN-WESTERN COMPANY
Subsidiary of Baldwin-Lima-Hamilton Corporation
AURORA, ILLINOIS, U.S.A.

When you build with **concrete**
reinforce it with
American Welded Wire Fabric Reinforcement

ASPHALTIC CONCRETE

American Welded Wire Fabric increases the life of asphaltic concrete. It adds strength . . . binds the whole slab into a tough durable unit. It was used with outstanding success in the resurfacing of the Public Square in Cleveland, Ohio and in many other asphaltic concrete installations.

ROADS

The New York State Thruway, shown here, as well as the Ohio Turnpike, Indiana Turnpike, Pennsylvania Turnpike, Kentucky Turnpike, and countless other highways and city streets throughout America have been made more durable and crack-resistant with American Welded Wire Fabric Reinforcement. Tests and other data show that for equal thickness of concrete and for comparable subgrades a Welded Wire Fabric reinforced concrete slab is approximately 30% stronger than an unreinforced concrete slab. For continuous reinforced concrete pavements, American Welded Wire Fabric can be obtained in wire sizes up to and including ½" in diameter at 2", 3", 4", and 6" on centers.

PIPE

Concrete pipe is far stronger and more durable when reinforced with American Welded Wire Fabric. American Welded Wire Fabrics are made in a complete size range for any type of sewer or culvert. American Welded Wire Fabric can now be obtained in circumferential wire sizes up to and including ½" wires at 2", 3", and 4" on centers.

BE SURE TO ASK "is it Reinforced"

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COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS • UNITED STATES STEEL EXPORT COMPANY, NEW YORK

EVERY TYPE OF REINFORCED CONCRETE CONSTRUCTION NEEDS

USS AMERICAN WELDED WIRE FABRIC

UNITED STATES STEEL

. . . for more details circle 180, page 16

Gets back on new slab sooner — speeds paving schedules

KOEHRING 16-E *twinbatch*® paver on rubber tires is as mobile as your batch trucks. It works on or off-pavement — can get back on new slab in as little as 7 days to pave adjoining highway strips, scattered intersections, approaches to driveways and side roads. This time-saving "run-about" makes self-powered moves at 9 m.p.h. Yet, for all its mobility, the Koehring 16-E *twinbatch* is primarily a production paver — exceeds the output of large single-drum pavers on main highway work. For instance —

On straight-production paving, the Koehring 16-E hits a top output of 86.7 batches an hour (based on 60-second mixing cycle). This *reserve* production capacity with *twinbatch* Autocycle mixing offsets normal job delays — lets you pick up lost time which cannot be made up with a limited production single-drum paver.

Averages 50 cu. yds. an hour

As a result, the Koehring 16-E *twinbatch* easily maintains an average of over 76 batches an hour — 8 hours a day. Based on 16 cu. ft. per batch, plus the usual 10% overload, this assures you 50 cu. yds. of concrete per hour — with a small crew — on your main-highway paving jobs.

While its usefulness is unlimited as a general-purpose paver, this versatile Koehring 16-E also serves as a mobile concrete mix plant. On construction of curbs, gutters, culverts, bridges, pilings, it discharges into overhead hoppers, forms, chutes, or loads trucks. Elevating boom reaches up and out 60° — gives controlled discharge at 21-foot height (higher with special boom).

See for yourself how the big production capacity, overall versatility, and rubber-tired mobility of this Koehring 16-E *twinbatch* can put you miles ahead on your paving schedules. Get all the facts from your Koehring distributor, or write us for 16-E catalog. Big 34-E *twinbatch* is also available for major highway, airport paving.

KOEHRING Company
Milwaukee 16, Wisconsin

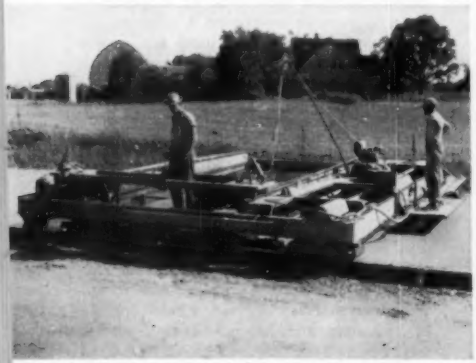
(Koehring Subsidiaries: JOHNSON • PARSONS • KWIK-MIX)

16-E serves as mobile mix plant—

pours footings, floors, columns, is never "grounded". Power-controlled boom swings in a 160° arc, or elevates 60° for overhead discharge. 24 cu. ft. bucket dumps anywhere along 25-ft. boom, has controlled discharge.

Big production 34-E twinbatch

hits a top output of 86.7 batches an hour (60-second mixing time). This reserve work capacity offsets normal production delays, assures an average of 50 batches an hour, 8 hours a day when you use a Koehring 34-E.



Keeps up with any paver—

"Timely", precision finishing is important on every paving job. Operating at almost twice the speed of a 34-E paver, Koehring Longitudinal Finisher handles all practical consistencies of concrete: harsh, wet, dry.

KOEHRING HEAVY DUTY

Digs within 12 inches of side obstructions

Off-set digging boom on Parsons 250 Trenchliner® puts trench within 12 inches of curbs, poles, buildings — digs almost directly behind either crawler. Reversible conveyor shifts through machine by power in less than 1 minute, discharges right or left. 250 production capacity: 3½ inches to 9¾ feet per minute. Widths: 16 to 42 inches. Depths to 12½ feet. Four other Parsons Trenchliners are also available in all sizes and types.

PARSONS • Newton, Iowa
(Koehring Subsidiary)

Portable, easy-charging 3½-S Dandie® mixer

With this Kwik-Mix ½-bag concrete mixer, charging height is low, only 43 inches. Convenient end-discharge, easy tilting drum, and unobstructed spotting area speed loading into wheelbarrows. Push down tow-pole gives safe, 1-man handling on the job, is easily hitched for trailing. Other models: side-discharge tilter, end-discharge non-tilt. Other concrete mixer sizes up to 16-S. Also: plaster-mortar, bituminous mixers and Moto-Bugs®.

KWIK-MIX • Port Washington, Wis.
(Koehring Subsidiary)

254 to 1321-barrel bulk cement plants

Easy to ship, simple to erect and re-assemble at next site, Johnson silos are all-welded in one piece, 11 or 12 ft. diameter. Single silo capacities: 254 to 611 bbls. Has screw conveyor, bucket elevator, receiving hopper, one or two 1,000-lb. batchers. Larger batcher, extra leg and elevator height available for charging mix trucks. Second silo at ground level increases total plant storage capacity up to 1321 bbls. of cement.

C. S. JOHNSON • Champaign, Ill.
(Koehring Subsidiary)

V69

. . . for more details circle 212, page 16

WHAT'S NEW in Equipment and Materials

15 Cu. Ft. Tractor Shovel

A 15-Cu.-ft. capacity tractor shovel for in-plant handling of bulk materials has been added to the Michigan line of rubber-tired tractor shovels by the Construction Machinery Division of Clark Equipment Co., Benton Harbor, Mich. Like larger units in the Michigan line, the new machine, designated the Model 12B, features a power-shift transmission, a torque converter with 3 to 1 torque multiplication, a planetary wheel axle and low level bucket action.

Of particular significance in industrial applications are the Model 12B's dust protection features. A filter for the torque converter oil and the power shift transmission oil is provided and a partial flow filter protects engine lube oil. Transmission, torque converter, starting motor, distributor and generator are all sealed.

Weighing 6250 lb., the Model 12B is available with either a 4-cylinder, 36 HP gasoline engine, or a 42 HP diesel engine, both with a 144 cu. in. displacement.

For more information circle 101 on Service Coupon this page and mail now.

Tractors and Scraper Units

Two new additions to its rubber tired tractor line have been announced by Caterpillar Tractor Co., Peoria 8, Ill. They are the DW21 (Series C) and the DW20 (Series E), both featuring more horsepower and major design changes over the current models of DW21 and DW20 tractors.

The tractors have a new diesel engine rated at 300 HP at 1800 rpm. Piston displacement is a full 805 cu. in. The six cylinder, 5¾ x 6½ in. diesel engine is turbocharged for greater horsepower. Driven by the engine's exhaust, the turbocharger utilizes energy that otherwise would be lost.

For more information circle 102 on Service Coupon this page and mail now.

Shoulder Maintainer

A new push type shoulder maintainer, announced by Gledhill Road Machinery Co., Galion, Ohio, will be known as The Gledhill push shaper and is intended to provide a shoulder maintainer that can be mounted on the truck's underframe or on the front push frame for snow plows.

It will utilize existing hydraulic equipment already in user's possession to raise or lower the blade instead of a snow plow. The weight is 600 lb. and it covers a 6 ft. span.

Working with traffic, its easy maneuverability and low cost are important features. In many cases it will work more effectively and at much lower cost than a motor grader according to the company's statement.

For more information circle 103 on Service Coupon this page and mail now.

3-Axle Tandem Roller

A new 3-axle tandem roller announced by The Galion Iron Works & Mfg. Co., Galion, O., has a variable weight range from 14 tons (metal weight) to 20 tons fully ballasted with water. In addition to the main compression or drive roll, it has twin guide rolls with synchronized hydraulic steering.

An important feature of the roller is that it is supplied with a Roll-O-Matic torque converter drive as standard equipment. The Galion Roll-O-Matic torque converter drive has no gear shift mechanism. Furthermore, it is stated to automatically multiply the engine driving force by means of oil in motion instead of by transmission gears, to automatically apply the driving force as the work demands, and to automatically maintain desired roller speed regardless of grade or working conditions. Elimination of master clutch, gear shifting, and shock loads, is stated to result in ease of operation. Rolling speeds from .8 to 5.5 mph are available. Engine braking power on downhill grades is smooth and effective.

For more information circle 104 on Service Coupon this page and mail now.

More equipment news pages 108-124

Portable Compressor Gives Low-Cost Operation

Maximum portability and low-cost operation are outstanding features claimed for the new Smith 45-P portable compressor introduced by Gordon Smith & Co., Bowling Green, Ky. The new model is designed to serve a wide range of compressed air needs that fall within its capacity, and is stated to give considerable operating savings over larger, heavier compressors. Smith officials state that the Model 45-P will operate such tools, individually, as a light paving breaker, a backfill tamper, a clay digger or two large chipping hammers. It is powered by a Wisconsin air-cooled 4-cylinder engine, with 2 cylinders used for power and 2 for compression. Compressed air delivery is rated at 45 plus cu. ft. per minute. The small compressor may be towed at car speeds to job vicinity, then hand pulled to exact spot where used.

Compressor gives automatic unloading and idling, has stainless steel valve discs with manganese bronze valve body. It is equipped with 9-gal. gasoline tank, and large capacity tool box.

Electric starter and generator is furnished as standard. Large fan cast in flywheel gives efficient, positive air cooling of cylinders and heads. Cooling system requires no maintenance. Pneumatic-tired wheels are reversible on hubs. They may be turned in when loaded on truck bed, and may be turned out for greater towing stability.

For more information circle 105 on Service Coupon this page and mail now.

For more items . . . see page 108

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22 West Maple Street
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Please send me further information on products and materials mentioned in the December Roads & Streets as circled below

About New Equipment and Literature:

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NOT GOOD AFTER JANUARY 15, 1956

A READER SERVICE FOR YOUR NEEDS

Quickest Way to Get a Refusal

Chrysler-powered jetting pumps help sink 1250 ninety-foot piles into hard-packed sand, averaging 25 per day

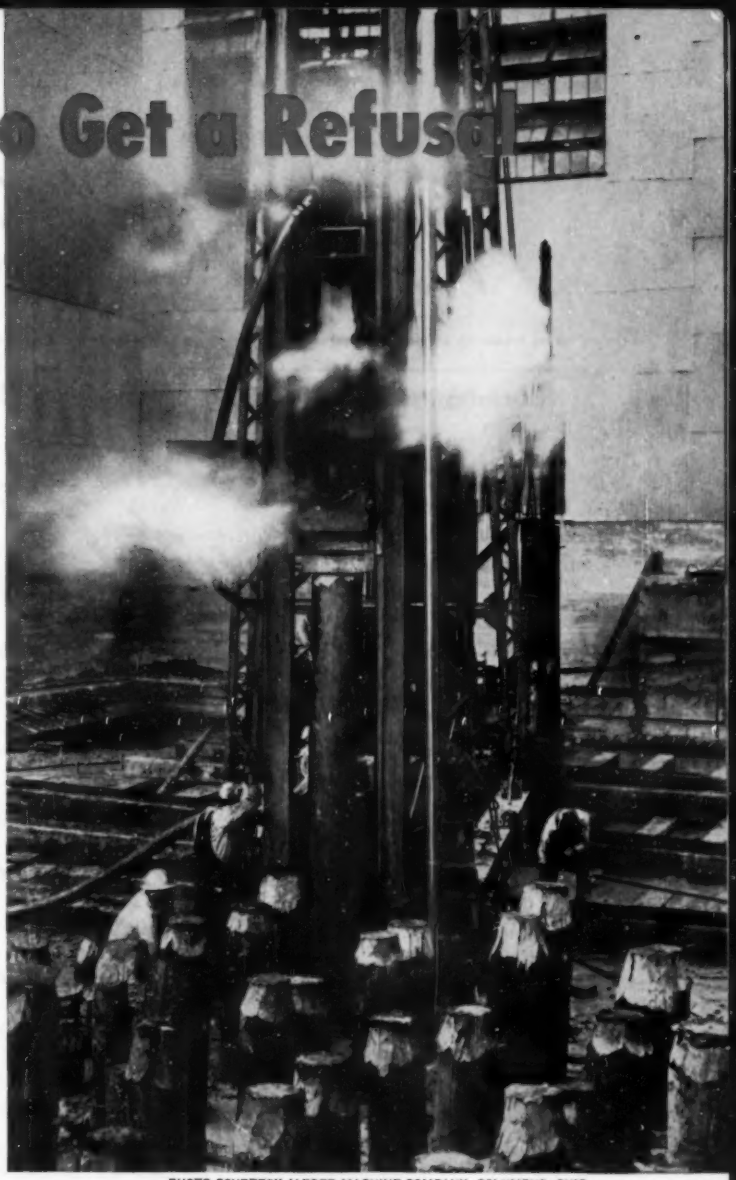

PHOTO COURTESY JAEGER MACHINE COMPANY, COLUMBUS, OHIO

Job: foundation for addition to large electric power plant. Objective: bring 1250 ninety-foot timber piles to bear on hard pan underlying tight-packed sand formation. Problem: impossible to drive piles into hard sand with hammer. Solution and method of operation: two Chrysler Ind. 32-powered high-pressure Jaeger jetting pumps operating in parallel or in series as necessity required.

It wasn't that simple, however. Hard-packed sand is never easy to penetrate. Operating in parallel the two pumps discharged 950 gallons per minute at 200 pounds per square inch pressure to blast holes more than eighty feet deep into which the piles sank with only the weight of the hammer. Six to nine minutes of driving with hammer then brought the piles to refusal at hard pan. When greater pressure was needed, the pumps were set to operate in series delivering 475 gallons per minute at 400 pounds per square inch. At many points sand formation was so tight the jet stream would work like a hydraulic piston and send pipe and all shooting out of the ground. To counteract this, extra-heavy pipe weighing over 2800 pounds was used.

Despite difficulties the jetting operation was handled with unusual speed. On the average it took about fifteen minutes to drive a pile to refusal. As many as 33 piles were put down in a single eight-hour day. The two Jaeger Model 5 CPH Pumps and Chrysler Ind. 32—265 cubic inch displacement engines required nothing beyond regular maintenance care.

Assure your users record-breaking performance with top operating economy. Power with *proven-dependable* Chrysler Industrial Engines—230 to 413 cubic inch displacement. A long list of optional equipment enables Chrysler to supply engines to meet end product requirements.

Chrysler Industrial Engines are not expensive. Production-line methods adapted to specialized industrial engine building provide custom-built engines at mass-production prices. See a Chrysler Industrial Engine Dealer, or write:

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265 CUBIC INCH
DISPLACEMENT

CHRYSLER *Industrial Engines*

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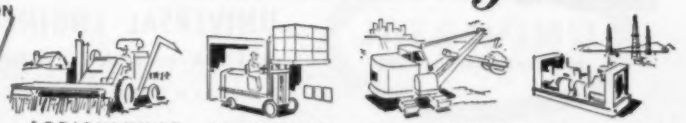
HORSEPOWER WITH A PEDIGREE



AGRICULTURE • INDUSTRY • CONSTRUCTION • OIL FIELDS

. . . for more details circle 189, page 16

New 30" x 26" Rolls

Greatest secondary crushing capacity ever offered in a plant of this weight

Giant Capacity

Gives you far more fine crushed material per hour. Has the ideal crusher for the big 4' x 12' screen

Universal 880 Senior "R"

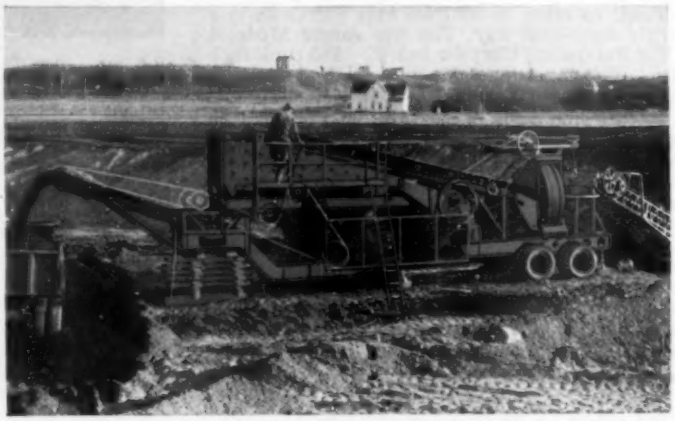
10" x 36" Jaw • 30" x 26" Roll Crusher • 30" Conveyors • 48 sq. ft. Screen

You want a plant that delivers screened and crushed material at a record rate and produces it at lower cost per ton. This is it!

The 880 Senior "R" teams a huge 48 sq. ft. screen with the biggest roll crusher ever offered, big, rugged 30" conveyors and a high capacity 1036 jaw crusher to give you a plant unequalled for high production in its weight class.

It's easy and economical to operate, too. You can adjust the jaw discharge quickly while standing on the ground—insures full control over primary crushing at all times. Dual clutch control on delivery conveyor speeds up truck loading of finished material. Plant operator or truck driver can control conveyor discharge.

Add to this—trouble-free V-belt drive, head-drive front delivery conveyor, extended operator's platform, plus the dozens of other advanced Universal features . . . and you've got a big, profitable, easy-operating plant that can't be matched. Write for illustrated bulletin, today!



Universal Senior 880 "R"—designed to meet highway weight limitations

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. . . for more details circle 235, page 16

ROADS AND STREETS
Sixty-Three Years of Editorial Leadership

Washington News Letter

By Duane L. Cronk

December 8, 1955

The most noteworthy highway news out of Washington last month was the Administration's statement that it will favor a pay-as-you-go financing plan, if necessary, to get a greatly expanded roadbuilding program underway.

Finance-wise, this is a complete swing away from the President's original "grand plan" in which $25 billion of bonds would be floated for a 10-year highway construction program on the National Interstate System.

Just after the defeat of the Administration bond bill during the last Congressional session, the President said he would compromise with the opposition to obtain the multi-billion-dollar program. Last month's new position - that the Administration will favor tax increases to raise the money - completed the policy shift.

* * *

The first conclusion one might jump to is that the major obstacle to agreement on a national road program has been removed. And, if one were dealing with objective issues in a rational atmosphere, that might be true. No one doubts now, however, that the highway proposal will be one of the hottest political issues of 1956 and that what is said from now on will often be more for effect than anything advocated previously.

Actually, tax increases to finance a pay-as-you-go program would provoke bitter debate. An election year is a poor year to suggest tax boosts. Many who might support a bond proposal for an ambitious roadbuilding program would take a second look at the size of the program when faced by pay-as-you-go proposals. They would challenge its scope and probably want it spread out over a longer period (15 or even 20 years instead of 10) to ease the burden.

* * *

The old battle between truckers and motorists would be bound to follow proposals of pay-as-you-go. The trucking interests repeated last month that they will go along with "across the board" highway user tax increases, but the nation's millions of automobile owners will probably insist that the big trucks pay proportionately more.

Some powerful governors will oppose pay-as-you-go schemes, also. Many had hoped that the national roadbuilding program would be bond-financed and will resent further "invasion" into the gasoline tax field by Uncle Sam.

(continued on next page)

The other major element of the Eisenhower "grand plan" is also coming in for increasing opposition...priority for construction of the National Interstate System, the proposed 40,000-mile main-line network that has been particularly in the dream stage for over a decade. Experts agree that economic and civil defense features of the system make it the first concern of the federal government. But the NIS is particularly susceptible in a political fracas; it lacks pork-barrel appeal. Congressmen whose districts the system does not cross will probably seek to minimize the importance of the network and ask for something more tangible to their constituents - such as more money for secondary roads.

Motel and roadside business interests are massing, also, for an assault on the Interstate System. Construction of the network, mostly on new access-controlled location, would put some of them out of business at their present stands. They are all "small businessmen" - a potent term in Washington these days. The whole concept of limited acces has yet to be debated in Congress. It probably cannot be evaded in any serious argument over the interestate network.

* * *

These are a few of the controversies that Washington observers expect to hear aired soon after Congress convenes next month. The "Pessimists" here are declaring that the original "grand plan" will deteriorate into just another federal-aid authorization, somewhat larger perhaps, as a sop. The "Optimists" believe that somehow public clamor for good roads will be aroused, forcing Congress to overcome the obstacles to a sound construction program. As frequently happens, the outcome may be some unforeseeable product of the middle ground.

* * *

Meanwhile, a 12% jump in roadbuilding next year has been forecast by the Departments of Commerce and Labor. In a joint report, these federal agencies have estimated that new road construction in 1956 would reach $4.6 billion, compared with $4.1 billion in 1955. With right-of-way added, this figure would become $5.3 billion. With maintenance, debt service and administration costs, the nation's expenditure for roads is expected to hit $8 billion in 1956.

* * *

Highway construction costs rose about 4% in the third quarter over the same period a year ago, according to the Bureau of Public Roads, which keeps a record of federal-aid projects. Greatest increases were in concrete - structural up 5.6%, pavement up 4.3%. Structural steel was down compared to 1954, but up considerably (8%) over the low prices of the second quarter 1955.

* * *

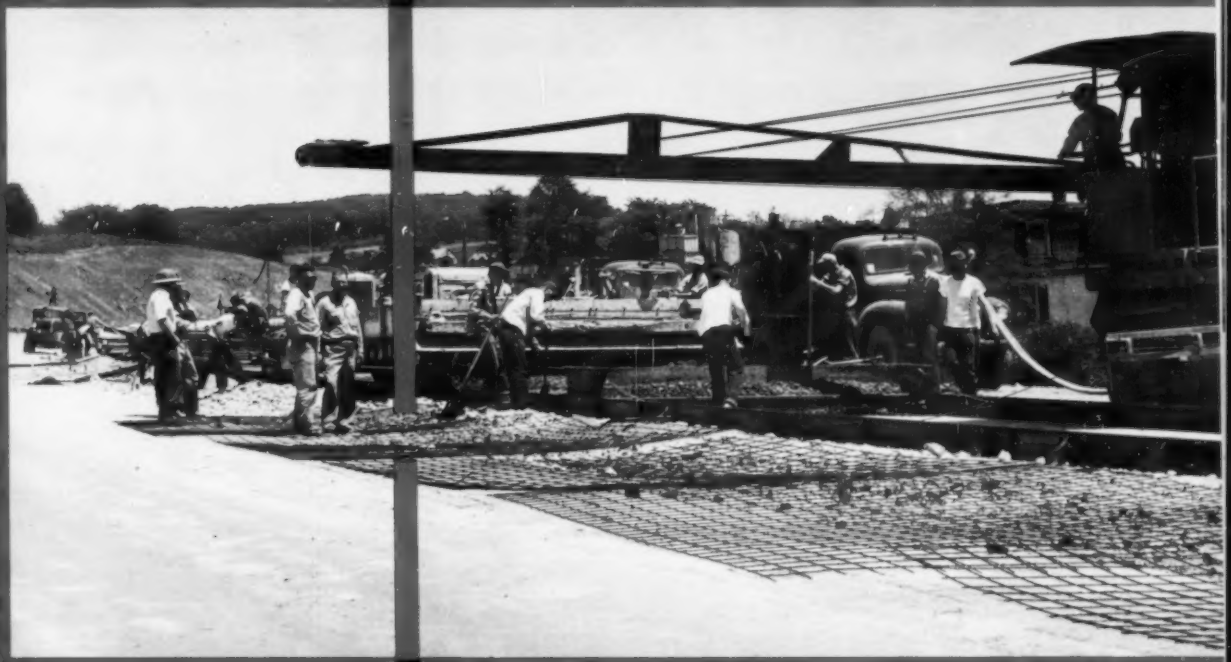
A survey of county highway engineers' salaries in 20 states has just been completed by the American Road Builders' Association. This is the first poll of salaries in this area in recent years.

* * *

More than $269 million in state highway user tax revenues were diverted to non-highway purposes last year, the National Highway Users Conference reported here last month. This amounts to an average of 7.4¢ out of every revenue dollar, although as much as 44% was diverted in some states.

CLINTON WELDED WIRE FABRIC

makes highway dollars work harder



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Clinton Welded Wire Fabric provides the backbone that highways need to stand up under today's heavy traffic loads.

Embedded in the concrete, Clinton Welded Wire Fabric distributes the load evenly, effectively controls cracking, materially increases road life and reduces maintenance. And, its firmly welded intersections of steel wire provide a positive anchorage for concrete.

Clinton Welded Wire Fabric is made in a wide range of gauges and mesh spacings to A.S.T.M. and A.A.S.H.O. specifications. For complete information, write the nearest district sales office shown on the back of this page.

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Concrete pipe, reinforced with Clinton Welded Wire Fabric, is a sound investment in terms of strength and durability, clog and corrosion-resistant service.

Clinton Welded Wire Fabric embedded in the concrete gives it high structural strength. The fabric, securely welded at intersections, affords both firm anchorage for concrete and uniform load distribution. This means fewer failures under even severe loading.

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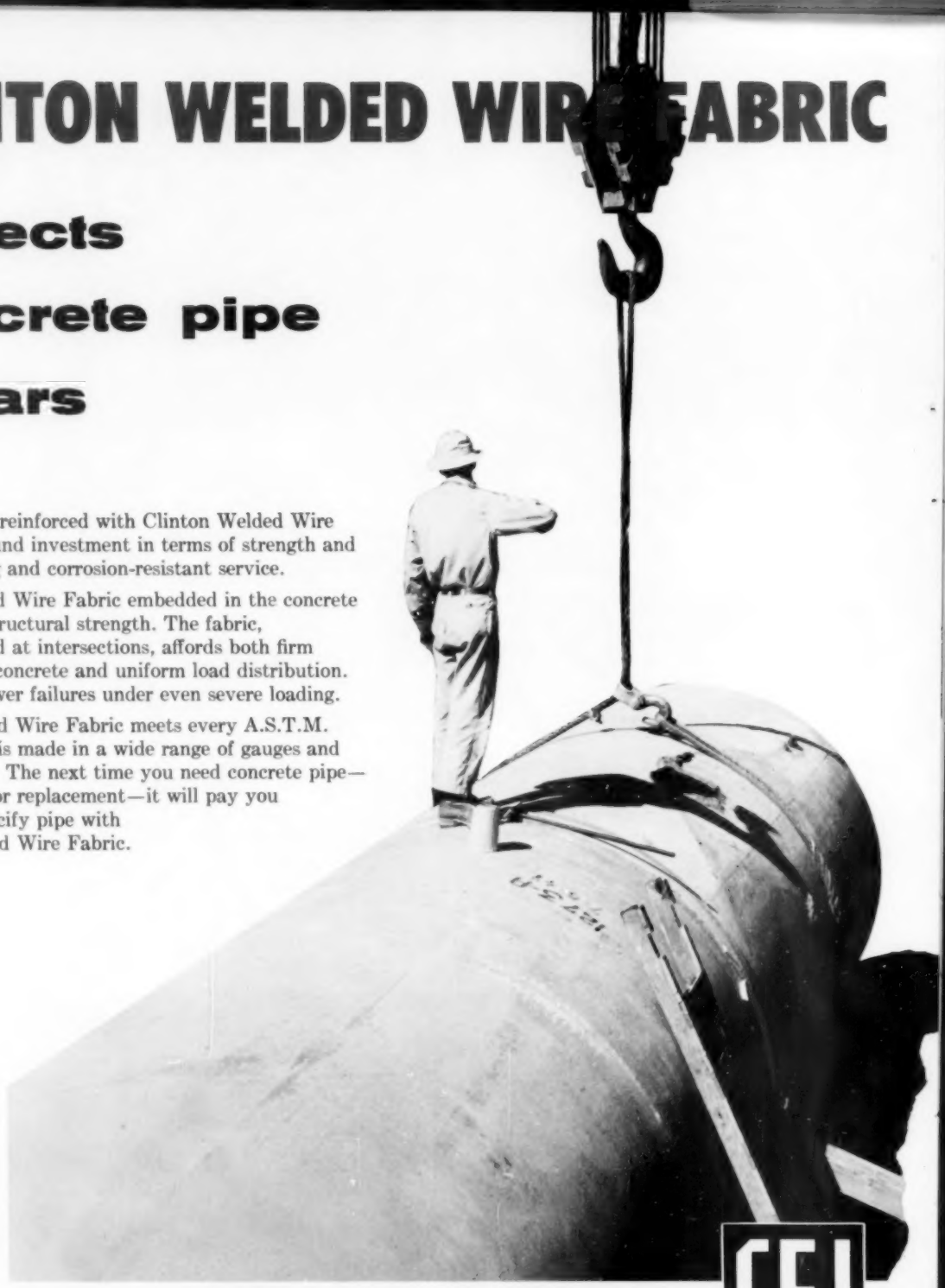

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Chevrolet trucks have got it! A full list of modern features that mean better business—on the job today and at trade-in time tomorrow!

When you get right down to it, any truck without all of Chevrolet's Task-Force features is still living in the past. Why risk losing money with an old-fashioned truck—both on the job and at trade-in time—when you can get a Task-Force model with the industry's most advanced features?

Most modern power—V8 or 6. There's longer life in Chevrolet V8's (extra cost in most models). With their short-stroke design—shortest of any leading truck—you can count on less friction and wear per mile. If you go for sixes—Chevrolet's gas-saving valve-in-head sixes are famous for their dependability. All engines are sparked by a modern 12-volt electrical system for quicker starting and smoother going!

Most modern comfort and safety features. New efficiency boosting advances like panoramic windshield, High-Level ventilation, softer seat action and concealed Safety Steps!

Most modern chassis features. New suspensions; new, more rigid frames; Power Brakes standard on 2-ton models!

See your Chevrolet dealer for details. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

NEW CHEVROLET Task-Force TRUCKS

CHEVROLET

. . . for more details circle 202, page 16

here . . . without a doubt . . . is the most useful buying catalog in your office

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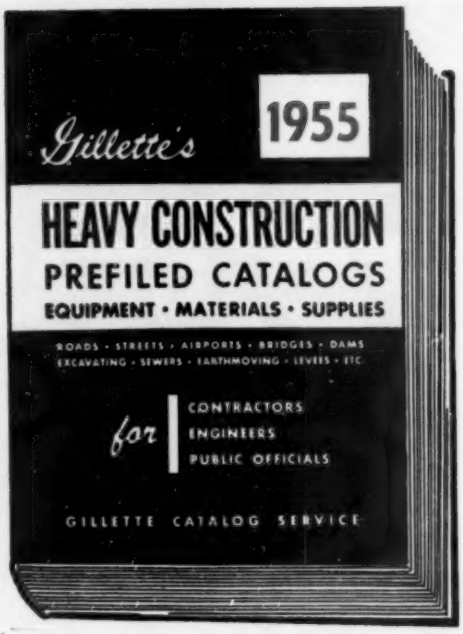

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Clark Equipment Company
Cleveland Trencher Company
Colorado Fuel & Iron Corp.
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Cummer & Son Co., F. D.
Cummins Engine Co., Inc.
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Electric Tamper & Equipment Co.
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Flexible Road Joint Company
Flintkote Co.
Galion Iron Works & Mfg. Co.
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Gar Wood Industries, Inc.
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La Crosse Trailer Corporation
Le Roi Company
Littleford Bros., Inc.
McKiernan-Terry Corporation
Mid-Western Industries, Inc.
Minneapolis-Moline Company
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Owen Bucket Company
Pacific Car & Foundry Co.
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United States Rubber Company
United States Steel Corp.
United Steel Fabricators, Inc.
Wellman Engineering Company
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Need 3-ton batches of bituminous concrete?
. . . 150 tons per hour of base course mix?
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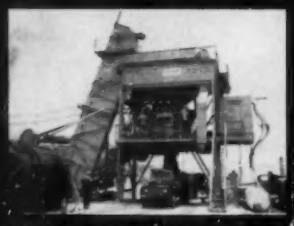
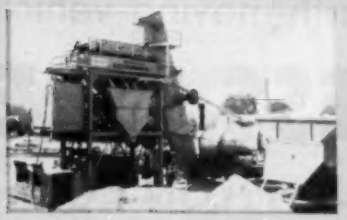
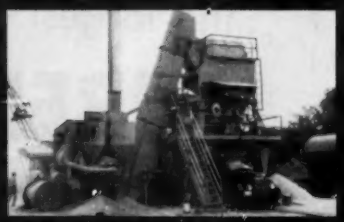


Model G60 produces 3 or more tons per batch, turns out 180 tons of asphaltic concrete per hour. Every new design feature known is incorporated in this plant.



Model G40 is just like the big G60 except for size and capacity. It's designed for jobs requiring around 120 tons per hour average.



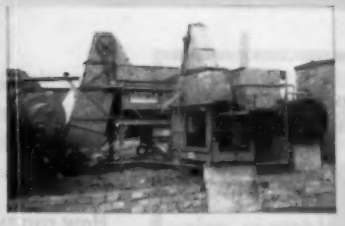
Model H15 is a batch type plant built for medium sized jobs where capacities of 35 to 60 tons per hour are required. The stack-up, tower-type plant is easy to move and erect.

Model CM continuous flow twin-shaft mixing unit is complete in itself for producing cold mix for small "commercial" type jobs.

Model CGC gradation control unit, with the famous Cedarapids Horizontal Vibrating Screen, can be added to the Model CM to meet exacting specifications.

Model 3612 or 4816 "Packaged" Drier is used with the CM or H15 plant to produce hot mix or high type bituminous concrete.

Dry Skimmer Type Dust Collector is designed for compact, simplified installation, increased efficiency and low maintenance.



Master Plant continuous flow twin-shaft mixing plant, incorporating gradation control unit and drier, produces up to 200 tons of specification mix per hour.

Charging Hoppers and Feeders, available in various sizes and styles, assure a steady flow of material into all types of bituminous mixing plants. Ruggedly built for long life.

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. . . for more details circle 211, page 16

At last! Tube and flap

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TUBELESS TIRES

BUILT WITH 3-T NYLON CORD
***plus* EASY-MOUNTING TRU-SEAL RIMS!**

Made in all earth-mover and grader types — including new Wide-Base and Conventional Cross Sections!

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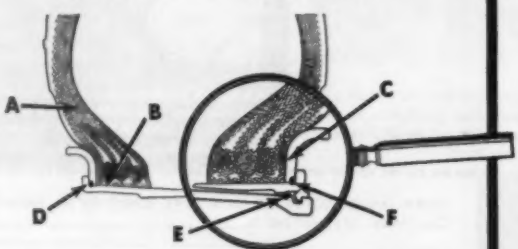

(A) 3-T NYLON CORD plies allow no air-seepage through tire.

(B) New-angle bead-base hugs Tru-Seal rim.

(C) Tru-Seal rim employs same general mounting principles as conventional rims.

(D, E, F) Tru-Seal rubber rings press into locking grooves, hermetically seal entire assembly—*automatically!*

Ever since it was first rumored that Goodyear engineering had scored again—that tubeless tires in even the BIGGEST SIZES were on the way—the earth-moving industry has buzzed with questions:

How can such huge tubeless tires be safely mounted?
How can they be made to hold air?
Will they actually end all need for tubes and flaps?
Will savings make change-over worth while?

THE ANSWERS ARE HERE—AND PROVED! Yes, proved in actual commercial operations—in iron mines, coal mines, copper mines, big road, dam and construction jobs—*and not a single case of major trouble of any kind has been reported!*

In fact, reports have been the most unconditionally enthusiastic in years! They're *attested* reports that add up to cost-cutting advantages like these:

troubles are gone forever!

EVEN THE *PRICE* IS WONDERFUL NEWS!
Goodyear's new tubeless earth-mover tires cost you no more than conventional tires with tubes.

No more expensive down time because of tube and flap trouble!

No more expensive tube replacement—a big factor on many jobs where tires outlast 2 to 3 tubes!

Faster, easier mounting and dismounting—no more double inflation, no more tubes and flaps to handle—and NO complicated mounting methods to learn!

Truly airtight assembly—Goodyear's exclusive 3-T NYLON CORD forms leakproof air chamber—and Tru-Seal rims *hermetically seal* the assembly!

Cooler running than conventional assemblies—means greater safety, longer tire life on long, heavy duty!

Slow leaks instead of blowouts—small, unnoticed injuries lead to blowouts in conventional tires. In Goodyear tubeless earth-movers, they may be detected and repaired *before* costly, dangerous damage!

Simpler, re-usable valve-parts—Goodyear's tubeless valve program means fewer parts to stock, less costly parts that can be used over and over again!

Goodyear tubeless earth-mover and grader tires will soon be available on new equipment from leading manufacturers.

Goodyear, Truck Tire Dept., Akron 16, Ohio

Buy and Specify

GOODYEAR

Tru-Seal—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

Look for this sign; there's a Goodyear dealer near you.

GOODYEAR TIRES

MORE TONS ARE HAULED ON GOODYEAR TIRES THAN ON ANY OTHER KIND!

. . . for more details circle 243, page 16

Uranium Strike!

Back in the hills of the Colorado Plateau, the dependability and low-cost operation of Le Roi Compressors pay off

Uranium is a magic name. And to anyone interested in low-cost, dependable, air compressor operation, the name of Le Roi is magic, too. Just take a look at a few features that keep Le Roi Compressors running after others have "called it quits":

- Suction and discharge valves are interchangeable.
- Cylinders have circumferential fins for better cooling — greater efficiency.
- Radiators and intercoolers have sectional cores.
- Larger air receiver reduces pulsation and cools the air so that tools run better.
- Larger engines for greater reserve power permit slower operating speeds, longer life.

Le Roi Compressors are available in sizes from 85 cfm to 600 cfm. Gas or diesel models and a complete selection of mountings. Bulletins give full details — write for your copy.

C-157

LE ROI *Division of Westinghouse Air Brake Co.*

Milwaukee 14, Wisconsin

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. . . for more details circle 214, page 16

An S-18 scraper spreads 21 yds. of clay on the fill. With 300 h.p. engine and Torqmatic Drive this "Euc" has plenty of power for fast loading, hauling and spreading even in the toughest going.

A total of 688 h.p. at work here! Two 194 h.p. engines in the Euclid TC-12 Crawler and 300 h.p. in the "Euc" Scraper made short work of getting heaped loads of sand in a hurry.

Dumping their big loads on the fly, Bottom-Dump "Eucs" made fast cycle time from borrow pit to fill and back again. They were loaded by 2½ yd. draglines and a Euclid Loader.

49 "EUCS" on Heavy Road Grading Job

Contractors who know their earth moving equipment use "Eucs" on the tough, rush jobs. They know from experience that they can rely on Euclids to get more work done at the lowest cost per yard . . . and keep doing it month after month.

This 6.3 mile road project in Illinois is a typical example. S. J. Groves & Sons Co., J. C. O'Connor & Sons Co. and Potashnick Construction Inc. put 49 "Eucs" to work on a total of 2,238,171 cu. yds. of earth excavation. Grading operations started the middle of July and were completed the end of September. These contractors used 24 Euclid Scrapers, 23 Bottom-Dumps, a "Euc" Loader and a new TC-12 Twin-Power Crawler . . 47 out of 68 hauling units on the project were "Eucs"!

Hauls from borrow pit to fill ran as high as 4500' and averaged about 3000'. Daily production was around 50,000 yds. Fills of 22' to 36' were necessary to raise the road above high water level of the Wabash and Little Wabash Rivers during flood periods. Operating personnel on this job — with the biggest fleet of earth moving equipment ever used on an Illinois road project — say that "Euc" performance played the major part in completing the earth moving in such fast time.

It's performance like this that makes "Eucs" important to the profit picture on hundreds of construction jobs . . a good reason why ***EUCLIDS are your best investment.***

EUCLID DIVISION GENERAL MOTORS CORPORATION, Cleveland 17, Ohio

Euclid Equipment

FOR MOVING EARTH, ROCK, COAL AND ORE

GM GENERAL MOTORS

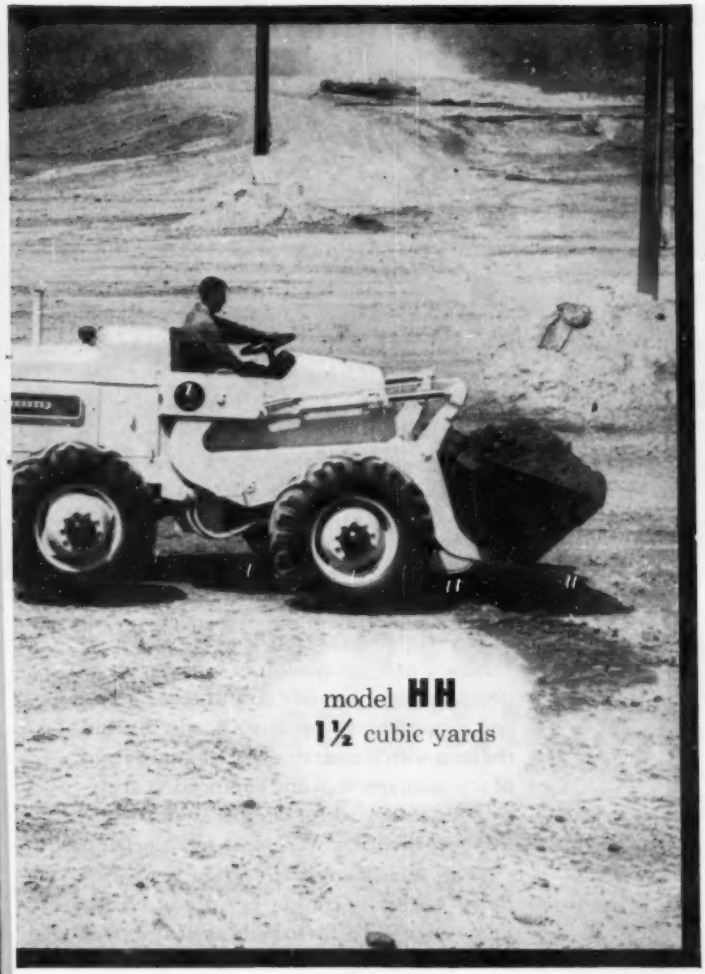
. . . for more details circle 204, page 16

the Big Three in

All new in design... New in performance

If you want the utmost in wheeled tractor-shovel performance, you want four-wheel-drive, and for the finest in four-wheel-drive you now have a choice of these three "PAYLOADER" sizes. They're all *new*, and each one is way ahead of its class in digging power, carrying capacity, stability, safety and operator comfort. They all feature an amazing new bucket action and boom arm design that is the big reason for the new performance pace they are setting for contractors, public bodies, mines, quarries, utilities.

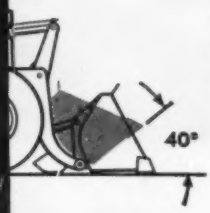
There's more horsepower per bucket capacity and many other proven Hough advantages that boost output and lower the cost of digging, scooping-up, loading, moving and piling earth and bulk materials. They all feature torque converter drives and multiple speeds in both directions as well as a new closed, pressure-controlled hydraulic system that minimizes dirt-intake and oil-foaming troubles. Your Hough Distributor is ready to demonstrate these great new "PAYLOADER" units and what they can do for you.



POWERFUL PRY-OUT ACTION

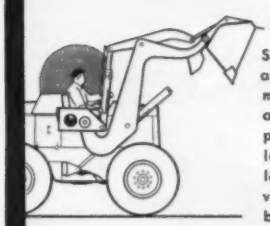
Tremendous pry-out force is obtained by using the breakout pads on the ground as a fulcrum for leverage. The load forces opposing the pry-out action are thus transferred to the ground through the pads instead of to the axle, wheels and hydraulic system of the machine.

40° BREAK-OUT at Ground Level



You can get HEAPED BUCKET LOADS and you get them FASTER and EASIER WITH THIS NEW BUCKET ACTION. Most important of all — you KEEP BIGGER PAYLOADS — because the bucket can be tipped back a full 40 degrees at ground level before it is raised, eliminating spillage.

SAFETY and STABILITY



Special boom-arm shape and positioning keeps moving members out of operator's reach at all positions. Close, low, load-carry position and longer wheelbase provide stability and balance for fast maneuvering — with safety.

Four-Wheel Drive

Your Hough Distributor's continues to be the place to get the most performance and satisfaction for your tractor-shovel dollar. For he sells the "PAYLOADER" line of wheeled tractor-shovels — the pioneer line and the most-proven, most complete line available. He has a "PAYLOADER" size to meet your requirements, whether for four-wheel-drive, rear-wheel-drive or front-wheel-drive types — along with the finest parts and service facilities to protect your tractor-shovel investment.

PAYLOADER®
MANUFACTURED BY
THE FRANK G. HOUGH CO. LIBERTYVILLE, ILL.
SUBSIDIARY—INTERNATIONAL HARVESTER COMPANY

THE FRANK G. HOUGH CO.
768 Sunnyside Ave. Libertyville, Illinois

Send full information on new "PAYLOADER" Tractor-Shovels

☐ Model HU ☐ Model HH ☐ Model HO

Name .....

Title .....

Company .....

Street .....

City .....

State .....

. . . for more details circle 207, page 16

Sharp, blind turns and "S" curves are killers. Engineers eliminate such hazards by designing modern roads like the one at the right with broad, sweeping curves that the driver can negotiate safely without slowing down.

Narrow bridges (right) are dangerous. Today engineers design bridges wide enough for expected traffic (above).

Inadequate sight distances such as at the right invite disaster. Modern highways need the built-in safety of long sight distances. Engineers eliminated blind spots in designing the highway above.

The Highway *Engineer* Is Solving America's Highway Crisis

America has outgrown its highways. There are 58 million vehicles jammed onto a road system designed for half that number. No one foresaw the tremendous increase in weight, volume and speed of traffic—developments that make yesterday's good roads congested and hazardous for today's traffic.

That so many of the concrete roads built in the '20s—and even earlier—are still serving is a tribute to engineering foresight and the durability of the pavement.

Now a new generation of highway engineers faces the gigantic task of redesigning and rebuilding the nation's roads. Behind the men who'll meet this challenge are years of scientific research and engineering analysis—the teamwork of engineers and scientists in colleges, government, the Portland Cement Association and other organizations. This cooperation has produced the knowledge and skills to build safer and more durable concrete roads than ever before.

In the next 10 years billions of dollars will be invested in a nation-wide highway improvement program now being planned. Needing attention first are 40,000 miles of roads designated by Congress as the Interstate Highway System. Only about 1% of the country's road mileage, this network carries 20% of the rural traffic and connects most of the nation's large cities. These routes are America's lifelines. Over them flow goods and services essential to the national welfare and defense.

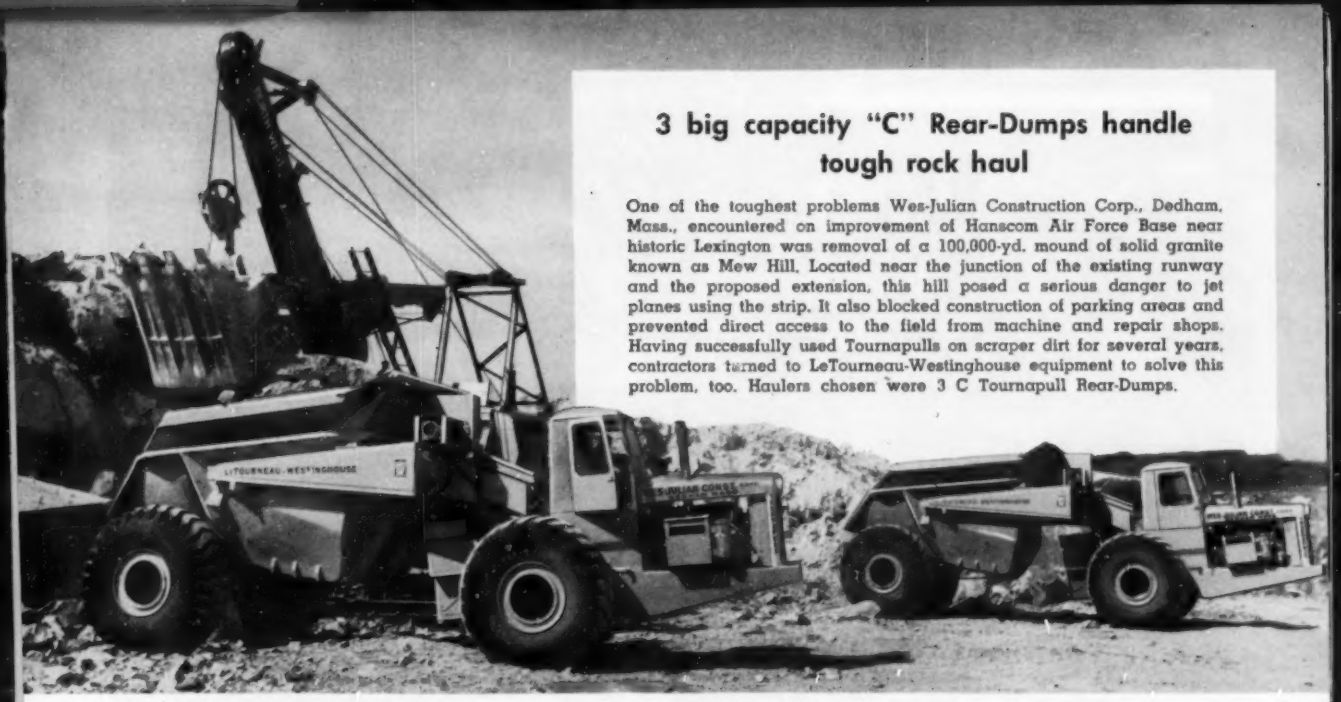
In redesigning and rebuilding the Interstate Highway System the highway engineer's goal will be safe, economical roads. Using ***low-annual-cost*** concrete, the safety pavement, will help him achieve this goal.

PORTLAND CEMENT ASSOCIATION

33 West Grand Avenue, Chicago 10, Illinois

A national organization to improve and extend the uses of portland cement and concrete . . . through scientific research and engineering field work

. . . for more details circle 225, page 16



3 big capacity "C" Rear-Dumps handle tough rock haul

One of the toughest problems Wes-Julian Construction Corp., Dedham, Mass., encountered on improvement of Hanscom Air Force Base near historic Lexington was removal of a 100,000-yd. mound of solid granite known as Mew Hill. Located near the junction of the existing runway and the proposed extension, this hill posed a serious danger to jet planes using the strip. It also blocked construction of parking areas and prevented direct access to the field from machine and repair shops. Having successfully used Tournapulls on scraper dirt for several years, contractors turned to LeTourneau-Westinghouse equipment to solve this problem, too. Haulers chosen were 3 C Tournapull Rear-Dumps.

Solving a rock hill problem on $3,885,000 Air Base job

Rear-Dumps usually were loaded in 4 to 5 passes of 2½-yd. Northwest shovel. Each load averaged 18 tons. Because one "C" carried as much as could 3 to 4 average dump trucks, often used on jobs like this, Wes-Julian needed fewer haulers and fewer operators. All-steel body construction also reduced maintenance. Capacity of this Model "C" Rear-Dump, without sideboards, is 18 tons. Newest "C's" carry 22 tons.

Leaving the shovel, these Rear-Dumps accelerate quickly . . . go rapidly over both well-maintained haul road and soft fill. Runway is being extended 2300'. Pavement will be 200' wide with 200' shoulders on either side. Several 75' wide taxiways to be constructed include one 1000' long and another 1500' long. At the eastern end of the 150 acre air field job, Wes-Julian will also construct a 250' long blast pad.

Fill is dumped at end of runway extension. Note how body swings below and behind rear wheels. This keeps material from piling under unit . . . combined with front-wheel drive, allows safe dump over edge of fill or steep banks when necessary. When Mew Hill has been leveled, Rear-Dumps will haul another 100,000 yds. of rock, hardpan, peat, and clay from other borrow locations to grade for 6 miles of connecting highways.

Turning to dump in tight quarters of this ditch is no problem for C Tournapull Rear-Dump. Despite overall length of 29', "C's" can make non-stop 180° turn in space only 27' wide. In dump position, this remarkable unit requires only 21' for a non-stop U-turn. Steer works independently of footing through geared kingpin that connects trailing unit with prime-mover.

Tournapull—Trademark Reg. U.S. Pat. Off. R-746 H-b

LeTourneau-WESTINGHOUSE Company

Peoria, Illinois

A Subsidiary of Westinghouse Air Brake Company

with Firestone
TRACTION CAP TREADING

You get all these Cost-Cutting Advantages

- **QUICK SERVICE** — Treading done in the field at strategically-located points.
- **BIG SAVINGS** — Save up to 74% of the new tire cost.
- **NO WASTE** — New rubber is applied only to worn tread area of tire — original shoulders are maintained. Heat is applied only to tread rubber.
- **INCREASES TIRE LIFE** — More hours per tread, more treads per tire.
- **ROCK GRIP TREAD DESIGN** — A proved new tire tread design made with special cut-resistant rubber. Gives greater traction, greater driver control, more hours of service and less side-slipping.
- **GUARANTEED** — Free from defects in workmanship and materials.

Contact Your Nearest Firestone Dealer or Store

Enjoy the Voice of Firestone on radio or television every Monday evening over ABC

Copyright 1955, The Firestone Tire & Rubber Co.

. . . for more details circle 197, page 16

Fingertip controls are easy to learn, easy to operate. After handling Tournatractor for only 30 hours, a previously unskilled operator was doing a good job of final grading.

Rubber-tired tractor builds new streets *for old Baghdad*

Baghdad today is a city of great contrast. On one hand, you see ultra-modern apartment houses, gas stations, and soft-drink stands. On the other are ancient mosques and mud houses. Modern buses and automobiles mingle with throngs of camels and donkeys. Construction goes on everywhere. Even ancient narrow stone streets are giving way to broad, blacktop avenues.

A typical road-modernization project is now being handled in the Adhamia Subdivision of old Baghdad by United Contracting Company. Their rubber-tired Tournatractor has proved invaluable for building the sub-grades before final bitumen paving. This unit maneuvers easily in the narrow streets. Its big low-pressure tires absorb shocks when traveling on rough stone and earth roads — yet roll over newly-laid pavement and curbing without causing damage. Its 19 mph speeds permit fast travel between assignments — even enable the mobile Tournatractor to shuttle back and forth and handle assignments on two or more scattered projects at the same time.

More work, lower cost

Tournatractor has reduced contractor's equipment inventory and payroll, too! Owners estimate it would have taken at least four 45 hp crawler-tractors and one or two motor graders to handle the work done by this single 186 hp tractor-on-rubber. This is partly due to the superior working speeds and mobility of the rubber-tired unit; partly to the large amounts of material it handles on every pass; partly to the effective compaction of the rocky sub-grades by its big low-pressure tires.

United Contracting Company is finding many uses for this versatile machine. With the recent purchase of a double-drum power control unit, it can be used to operate a scraper or rooter, in addition to dozing and pushing. Thus, the company can now accept contracts for work that formerly had to be refused or sub-contracted.

Only one hour for repairs

When last checked, the Tournatractor had worked 1,967 hours on all types of jobs. Despite continuous operation in temperatures which varied from a high of 129° to a low of 35° (F.), it had been down only 1 hour of the 1,967 for repairs.

Ask for more information

Hundreds of progressive contractors all over the world are taking advantage of the ease of maintenance, speed, and high rates of production offered by Tournatractors. If you are interested in these same economies for your work, contact your LeTourneau-Westinghouse Distributor. He will be glad to give you complete information on these rubber-tired tractors.

Tournatractor dozes capacity 2½-yard load of silt, clayey loam, gravel, gumbo, and rock. Push distances range from 100' to 1000' depending on cut and fill required. Some material is drifted to both sides of the street to build up foundations for sidewalks. Low-pressure tires do not harm finished grades even after heavy rain.

Tournatractor—Trademark T-697-H-b

. . . for more details circle 241, page 16

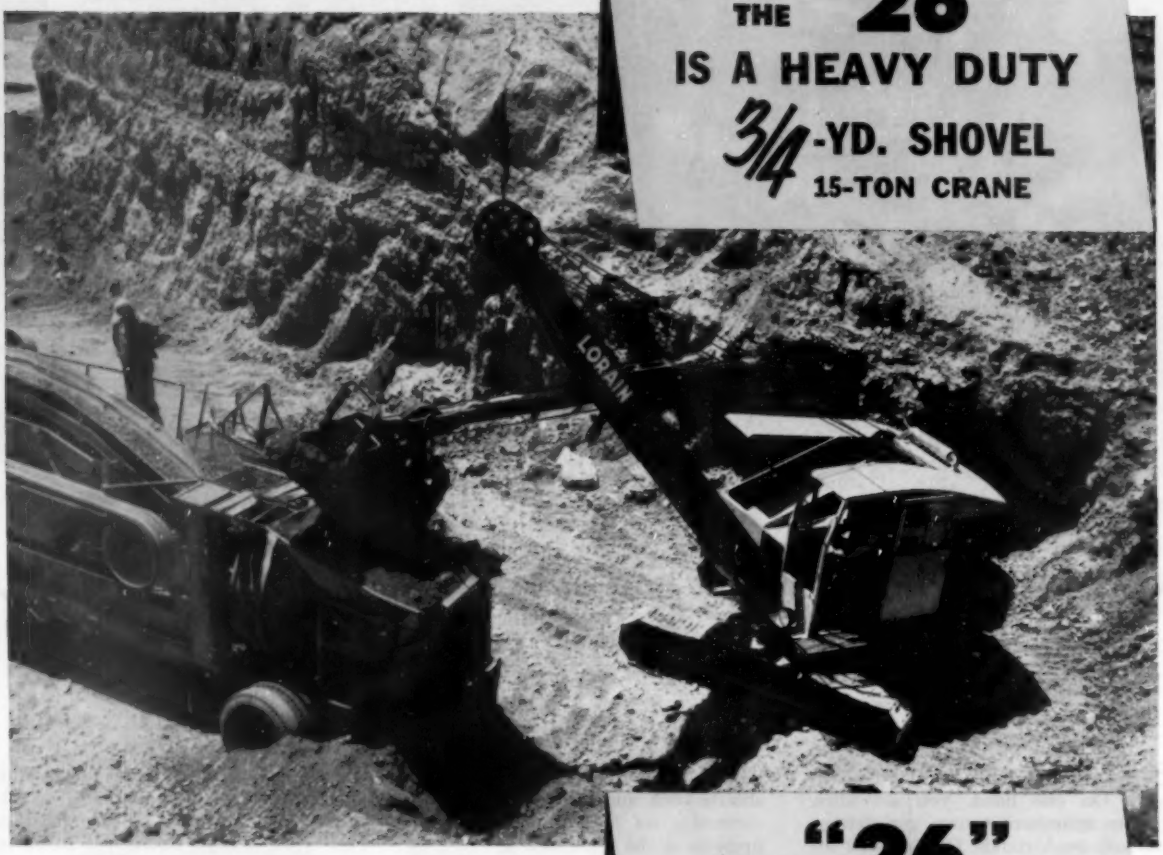
LeTourneau-Westinghouse Company

PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Co.

LORAIN SAYS . . .

THE "26" IS A HEAVY DUTY 3/4-YD. SHOVEL 15-TON CRANE



THIS LORAIN OWNER SAYS...

THE "26" "CONSTANTLY STANDS TERRIFIC DIGGING STRAIN"

AND HERE'S WHY—this combination of features found in no other machine!

New Lorain "E-Z" Controls • "Big Look"—larger, wider cab for greater operator comfort • "Hydra-Ease" power control of crawler steering, tread lock, house lock and shifting of swing-travel jaw clutches.

Hydraulic Coupling power take-off for no-stall, no-shock, "never-say-die" smooth application of power • No digging shocks transferred to mechanism.

5 identical, Interchangeable Shoe Clutches • Bigger clutches with 18% more capacity, plus new, easier action, longer-life design • 19 anti-friction bearings on power shafts and clutch drums.

19 ft. shovel boom for maximum reaches—powerful, independent cable crowd • Much greater weight—over 47,000 lbs. as a shovel • 15-ton crane capacity with 2-piece pin-connected boom • Power load lowering standard • Ability to back-down the load • Third Drum available.

Newly-designed, sturdier, wider, 2-speed Crawlers with 29-inch wide drop-forged treads • 2 crawler speeds in both directions • Oil-enclosed crawler travel mechanism • 4-way, positive Tread & Travel Lock—fully enclosed.

Truss-type Turntable Bed • Hook Rollers—front 2 are on anti-friction bearings.

The best test for any shovel is on the job. That's where product claims must be proved . . . and that's why Partner and Manager C. R. Davis of the Albany Gravel Co., Albany, Mo., says far more in these words than any claims Lorain may make . . . *"Our Lorain-26 is used for digging natural gravel from a solid deposit. It stands terrific digging strain constantly and takes hard digging abuse exceptionally well."* This is just one owner's reaction to the new Lorain-26. See your Thew-Lorain Distributor. He can show you Lorain-26's at work.

THE THEW SHOVEL CO., LORAIN, OHIO

THEW LORAIN®

. . . for more details circle 232, page 16

What this exclusive differential does:

In area of overall good footing, LeTourneau-Westinghouse differential allocates power equally to both drive wheels.

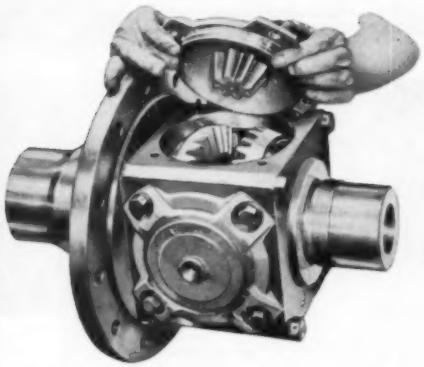
When one wheel hits a soft spot and begins to slip, differential automatically transfers up to 4 times its power to wheel on firmer footing.

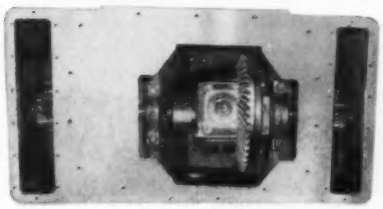
As slipping wheel starts to grip, power begins to equalize, until on firm ground, both drive wheels pull evenly.

On a curve, differential automatically adjusts wheel speeds for smooth, sure control. There's power on both drive wheels at all times.

Why you get more yards when

power is automatically transferred to wheel on firmest footing





With Tournapull differential, as soon as one wheel hits a slippery spot and tends to spin, idler pinions are forced outward against friction surfaces. This automatically slows the slipping wheel, and transfers up to 4 times its tractive effort to wheel on firmer footing. Neither wheel will spin independently until the 4 to 1 ratio is exceeded.

1. Since power is transferred where it can be best used, you pull through easily where other rigs bog down . . . haul loads where many can't pull through empty.
2. Wheel "spinning" is practically eliminated . . . tires don't cut in.
3. You can work in almost any material . . . mud, loose sand, snow . . . keep rigs earning in what is normally considered shut-down weather.
4. You can extend your work season earlier in spring, later in fall.
5. You ride curves easier, safer, faster because differential equalizes tire travel, gives you better traction and better control.
6. Tire wear is reduced through elimination of slipping, spinning.
7. There is less gear shifting necessary, less loss of momentum . . . you get faster cycles.
8. Power-transfer differential works automatically at all times . . . no control action needed . . . no special maintenance is required.

Investigate this revolutionary and exclusive power-transfer differential. It is standard on all LeTourneau-Westinghouse prime-movers . . . makes a major contribution to their ability to work a longer season, cut weather delay, haul larger loads through tough going, gives a faster cycle on any kind of footing.

Ask for a demonstration to see for yourself how this power-transfer differential can make more money for you. Why not do it now?

This power-transfer differential is used on all sizes of LeTourneau-Westinghouse electric-control Tournapull-scrapers, rear-dumps, bottom dumps, flatbeds, cranes, and logging arches.

Tournapull—Trademark Reg. U.S. Pat. Off. P-780-G-b

A Subsidiary of Westinghouse Air Brake Company

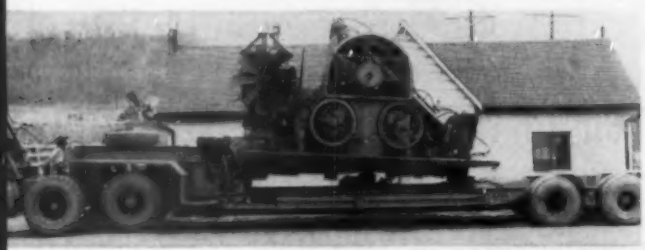
LeTourneau-Westinghouse Company

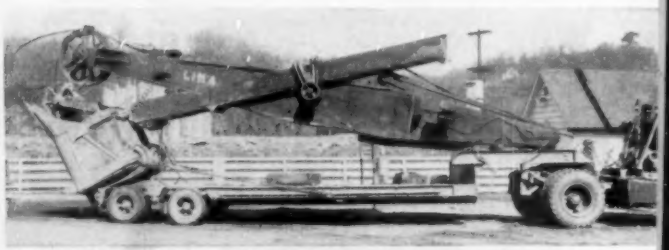
PEORIA, ILLINOIS

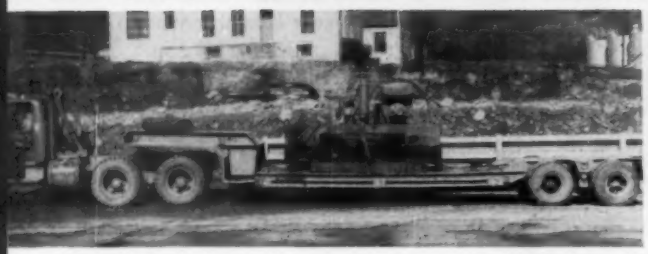
C. F. Replogle Co. reports:

"4 yd. LIMA 1601 knocked down, trucked 125 miles and reassembled in 3 days"

C. F. Replogle of C. F. Replogle Co., Circleville, Ohio, writes: "We really benefit from the fact that our new 4-yard Lima 1601 shovel knocks down for over-the-road transfer from job to job. We've knocked it down, moved it 125 miles and reassembled it in three days' time. During the eight months we've had it, the 1601 finished shovel work on three jobs and started a fourth.







"The Lima 1601's 400 hp diesel with torque converter 'toys' with a 4-yard rock bucket. It eliminates the necessity to 'clutch' the hoist, and multiplies hoist line pull under load to maintain hoist speed. Cable, gear and shaft breakage due to shock loads are eliminated. The machine consistently loads one E-18 Tournarocker (10 plus pay yards) per minute.

"The new 1601 even digs laminated rock that would usually require drilling and shooting. And its rugged construction cuts maintenance costs. To date, our 1601 has loaded out over 800,000 yards of rock without a single mechanical failure. We got all this for an original capital investment considerably less than we'd spend for other like capacity machines."

You can get all these benefits with the new Lima Type 1601! Send today for our new booklet containing detailed specifications. Write Construction Equipment Division, Baldwin-Lima-Hamilton Corporation, Lima, Ohio . . . or see your nearby Lima distributor.

LIMA SHOVELS · CRANES · DRAGLINES · PULLSHOVELS

BALDWIN-LIMA-HAMILTON

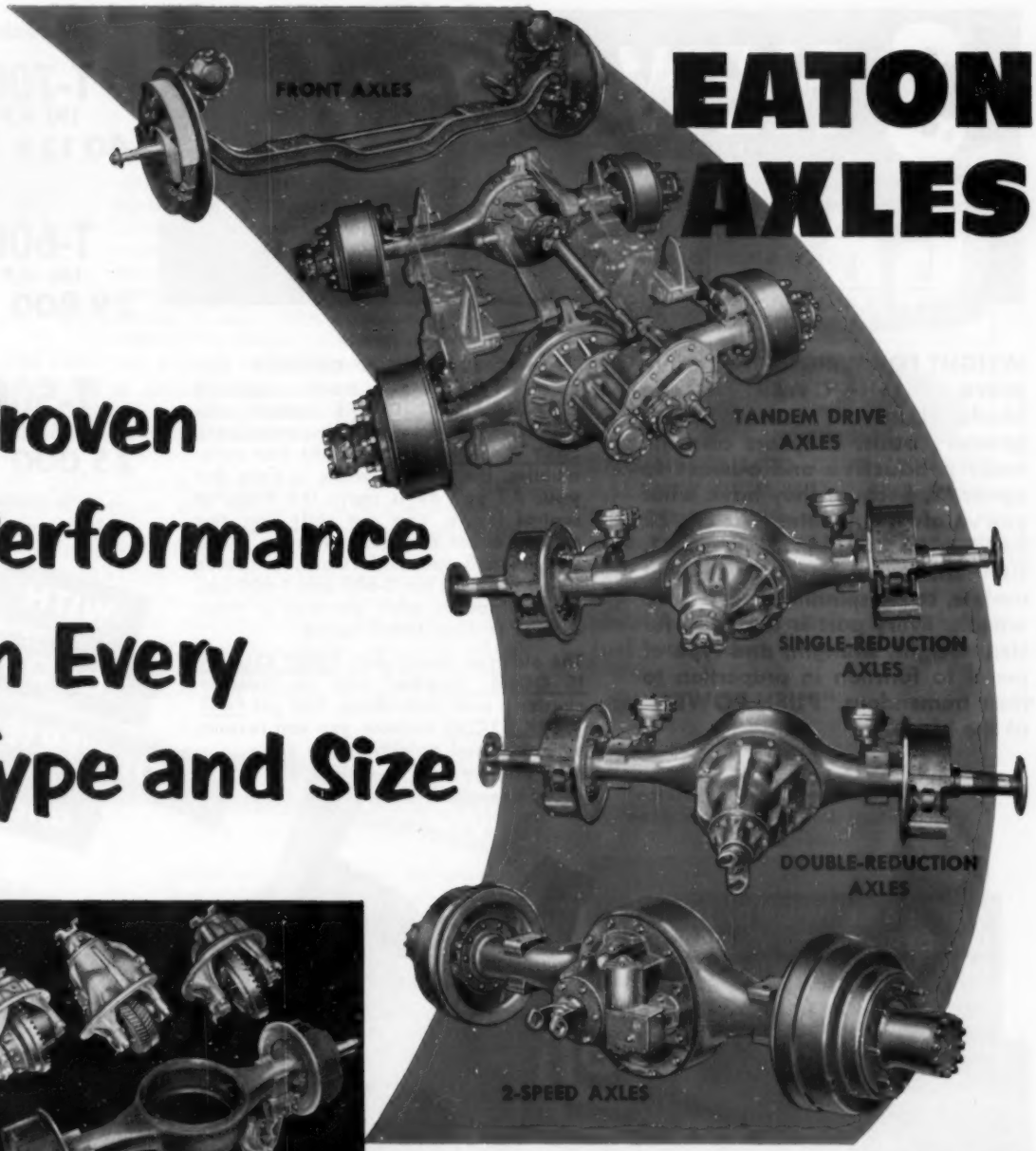
Construction Equipment Division · LIMA · OHIO · U. S. A.

DISTRIBUTORS IN PRINCIPAL CITIES OF THE WORLD

. . . for more details circle 181, page 16

EATON AXLES

Proven Performance in Every Type and Size



The rugged housing used in famous Eaton 2-Speeds is also used for Eaton single-reduction and double-reduction axles—the three heads are interchangeable.

Behind every Eaton Axle there is almost a half-century of truck axle manufacturing experience. The advanced engineering and quality construction which have made Eaton 2-Speeds famous for stamina and low-cost hauling are also found in Eaton single-reduction, double-reduction, tandem drive axles, and front axles. In more than two million motor trucks, Eaton experience and engineering know-how are reflected in outstanding performance records, minimum hauling costs, and longer vehicle life.

EATON — **AXLE DIVISION**
MANUFACTURING COMPANY
CLEVELAND, OHIO

PRODUCTS: Sodium Cooled, Poppet, and Free Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Rotor Pumps • Motor Truck Axles • Permanent Mold Gray Iron Castings • Heater-Defroster Units • Snap Rings Springtites • Spring Washers • Cold Drawn Steel • Stampings • Leaf and Coil Springs • Dynamatic Drives, Brakes, Dynamometers

. . . for more details circle 196, page 16

3 NEW BIG GALION GRADE-O-MATIC MOTOR GRADERS

Models

T-700
190 H.P.
40,125 lbs.

T-600
140 H.P.
29,800 lbs.

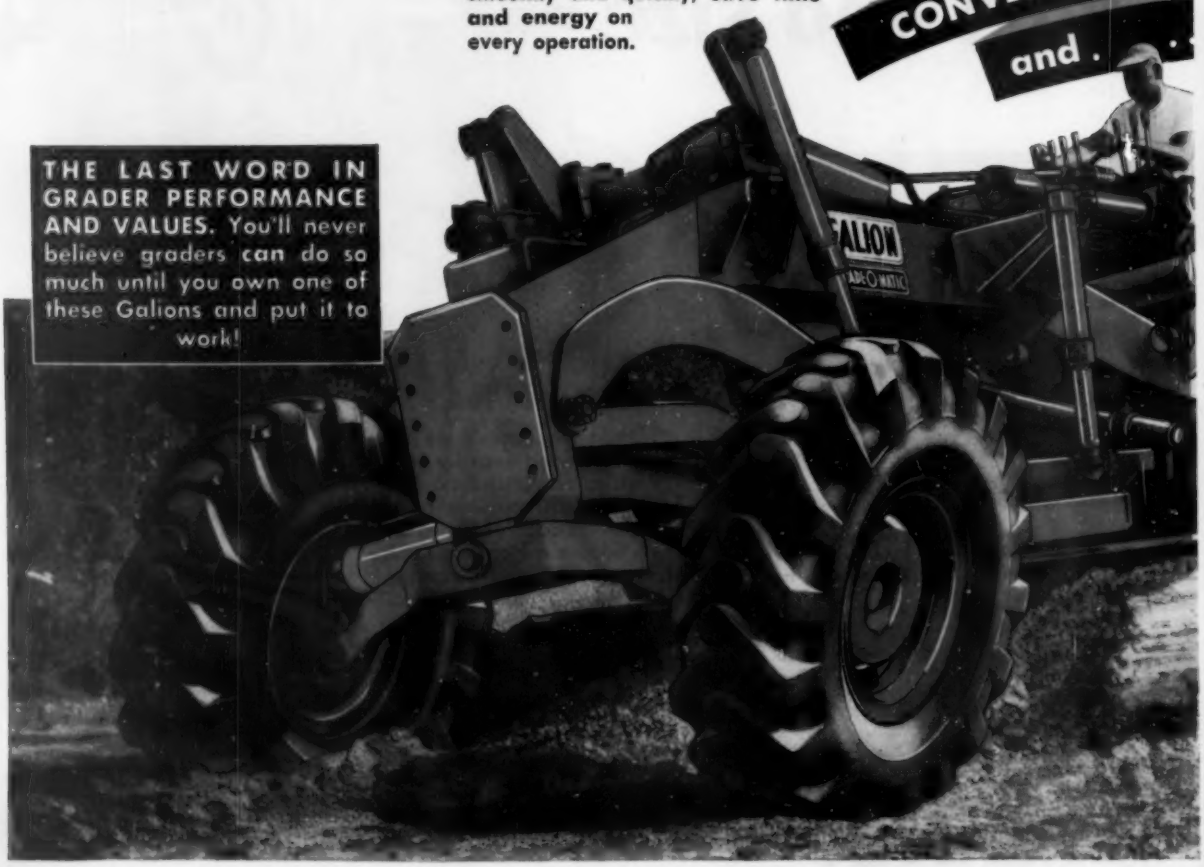
T-500
125 H.P.
25,000 lbs.
with scarifiers

WEIGHT FOR WEIGHT they have more "PUSH-POWER" at the blade than any other motor graders built. They are also the most productive and easiest to operate, because they have what you've always wanted — POWER BALANCED TO MATCH WEIGHT. They utilize their power without useless, costly spinning of the drive wheels. Every part is designed for size, weight, strength, and type of metal to function in proportion to their tremendous "PUSH-POWER" at the blade.

These three GALION GRADERS also have what you now need — GALION GRADE-O-MATIC DRIVES (torque converters and power-shift transmissions). EASY TO SHIFT, much like the best automobiles, the shifting work is done for you. All you do is move the fingertip control levers. You can shift "on the go" in either direction. With the T-700 you have 3 speeds forward, 3 speeds reverse — with the T-600 and T-500 you have 4 speeds each direction — from creeper to high travel speed.

The old type heavy duty FOOT CLUTCH IS GONE, together with its tiresome clutching and declutching. You get FAST WORK CYCLES because you can reverse smoothly and quickly, save time and energy on every operation.

WITH TORQUE CONVERTERS and . . .



THE LAST WORD IN GRADER PERFORMANCE AND VALUES. You'll never believe graders can do so much until you own one of these Galions and put it to work!

It's the "PUSH-POWER" at the Blade that counts!

- With these **TORQUE CONVERTER** and **POWER-SHIFT TRANSMISSION** combinations, the power is transmitted automatically in an infinite number of ratios. You get, in addition to effortless, automatic shifting, quick increases of torque multiplications to over 300% — automatically as needed. The torque converters also absorb the load shocks and prevent engine lugging or stalling.
- With this kind of smooth, shockless power transmission, effortless shifting, and balance of weight to horsepower, you get more work done easily than you ever thought possible.
- **HEAVY DUTY DIESEL ENGINES** are designed and matched to perform with torque converters and power-shift transmissions for maximum economy and efficiency for each size grader.
- **FOOT DECELERATORS** — for quickly reducing engine speeds and for increased ease of operation, permit immediate return to travel speed without changing the hand throttle.
- **TAIL SHAFT GOVERNORS** on the torque converters adjust the engine speed automatically to meet all loads or conditions — at any predetermined working or travel speed.

"PUSH-POWER" AT THE BLADE is the only power that counts in rating the efficiency and work production value of a motor grader.

ENGINEERED TO GIVE CORRECT BALANCE OF WEIGHT AND POWER. Graders with too much engine power and not enough grader weight spin their drive wheels, dig in, or side slip. High engine power, if not completely utilized, results in constant fuel waste and excessive tire wear.

. . POWER-SHIFT TRANSMISSIONS

Diesel engine, torque converter, power-shift transmission, and muffler are **STANDARD EQUIPMENT** on each model. Shiftable moldboard and 4-wheel brakes are standard equipment on Models T-600 and T-700.

GRADE-O-MATIC MOTOR GRADERS retain all the famous GALION features which also make for easy operation and increased production.

- Hydraulic booster steering.
- Extra-large positive traction tires — same size front and rear.
- Extra heavy and rugged front axle assembly.
- Extra sturdy box-type, single member frame; high-arched for maximum blade adjustments.
- Full visibility of work.
- Complete and effortless blade adjustments.
- Full hydraulic operation with fingertip controls.
- Comfortable platform and seat — with stand-up height weatherproof cabs available.

Send for literature and complete information.

THE GALION IRON WORKS & MFG. CO., Gen. and Exp. Offices, GALION, OHIO, U.S.A.
Cable address: GALIONIRON, Galion, Ohio

. . . for more details circle 201, page 16

In every size, Link-Belt Speeder offers

more speed, stamina, power, work-time!

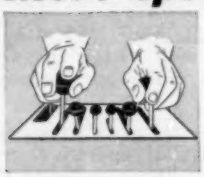
PATENTED SELF-CLEANING CRAWLER TRACK of LS-98 saves you money. Staggered shoe lugs and drive sprocket lugs force foreign material out, preventing excessive wear on drive mechanism—one of many bonuses.

13,798

You're ahead on every job—

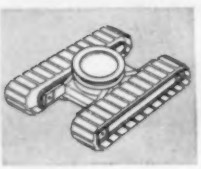
because Link-Belt Speeder is *years ahead* of the shovel-crane industry. Only Link-Belt Speeder offers you Speed-o-Matic's true power hydraulic control and so many other outstanding design and construction advantages. For facts on every machine in the ½ to 3-yard, 10 to 60-ton work range, contact your Link-Belt Speeder distributor. Link-Belt Speeder Corp., Cedar Rapids, Ia.

More speed—



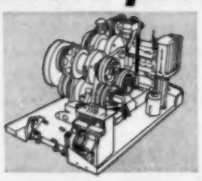
Speed-o-Matic, the true power-hydraulic control—smooth, positive response—perfect "feel" for speed with accuracy. Engineered to consider the human factor, greatly reduces operator fatigue.

More stamina—



A Link-Belt Speeder withstands continuous heavy-duty, high-speed operation. For proof, compare similar sized rigs with and without counterweights. Link-Belt Speeders have more "live weight", more strength built into every component.

More power—



Get more line pull, more digging power, lower fuel costs. Link-Belt Speeder design calls for precision-machining, anti-friction bearings and splined shafts at every point that helps transmit *rated hp* into *usable* hp.

More work-time—

A bigger percentage of shift is spent in actual "work-time." By minimizing operator fatigue, Speed-o-Matic boosts output up to 25%; also eliminates frequent on-the-job clutch adjustments and maintenance.

Visit your Link-Belt Speeder distributor and see these great machines first hand. A demonstration can be arranged at your convenience to prove that Link-Belt Speeder gives you most for your money.

LINK-BELT SPEEDER

Builders of a complete line of crawler and rubber-tired shovel-cranes

. . . for more details circle 216, page 16

75 YEARS OF BUCYRUS-ERIE LEADERSHIP . . .

December 18 marks Bucyrus-Erie's 75th Anniversary. In the years since 1880, the company has been proud to bring many significant advancements to the design of excavators . . . the first electric excavator . . . the first crawler-mounted dragline . . . the first diesel shovel . . . and too many more "firsts" to detail here. Most important, however, the know-how back of these is yours in whatever Bucyrus-Erie machine you use.

President Theodore Roosevelt Visits Panama Canal: This Bucyrus-Erie shovel, one of 77 used on the Big Ditch, was included in his 1908 inspection tour.

The 1½-yd. 38-B has a world-wide reputation for outstanding performance. Bucyrus-Erie offers general purpose excavators ranging from ⅜ yds. up.

. . . GIVES YOU TOP PERFORMANCE TODAY . . .

You can expect top performance from a Bucyrus-Erie excavator because it's *built right in.* It starts with Individual Design — which means that each model in the line is designed from the ground up to handle the rated load. There is no over-powering or over-dippering to create "new" models. Parts are properly proportioned, operating functions are effectively balanced. This results in fast work cycles and big payloads, with maximum time on the job and long service life. The extras Bucyrus-Erie puts into the design and construction of excavators pay off many times over in added output and lower cost operation.

. . . PROMISES EVEN BETTER EXCAVATORS TOMORROW

You can expect even higher performance standards from Bucyrus-Erie excavators in years to come. The development of new and improved designs, and the search for better materials and more efficient manufacturing methods never ends. With facilities unsurpassed in the industry, Bucyrus-Erie promises you excavators that will serve you better than ever.

20Y55C

1880 BUCYRUS ERIE *1955*

South Milwaukee, Wis.

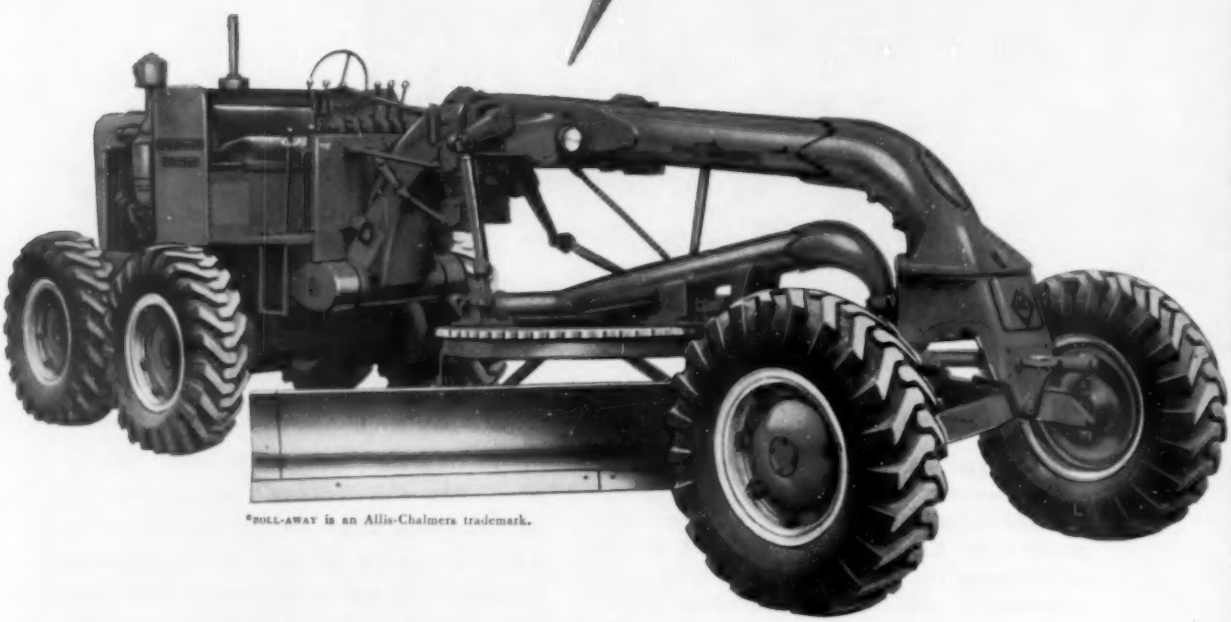
75 Years of Service to Men Who Shape the Earth

. . . for more details circle 185, page 16

NEW BIG SCALE PERFORMANCE

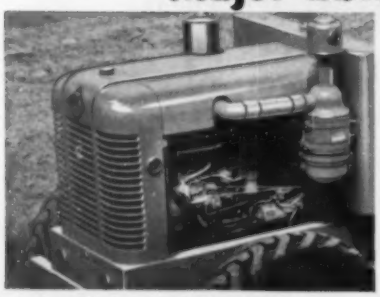
NEW OPERATING EASE AND COMFORT

ALLIS-CHALMERS BIG NEW

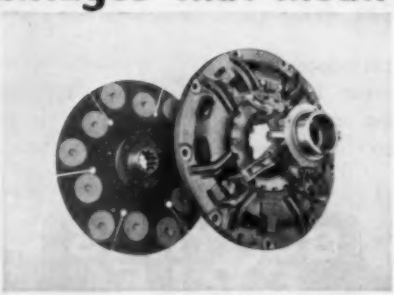


*ROLL-AWAY is an Allis-Chalmers trademark.

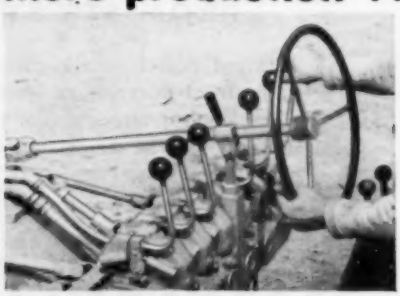
Major advantages that mean more production . . .



Powerful new Allis-Chalmers diesel featuring exclusive "follow-through" combustion for smooth performance, clean combustion, extra-long life.



Exclusive new ceramic clutch lining sets new standards of long clutch life, keeps clutch operating longer between adjustments, reduces lever pull.



All-new toggle-type controls give a *Forty Five* operator precision control with positive "feel" — in addition to easy finger-tip action regardless of load.

Forty Five MOTOR GRADER

120 HORSEPOWER • 23,800 POUNDS

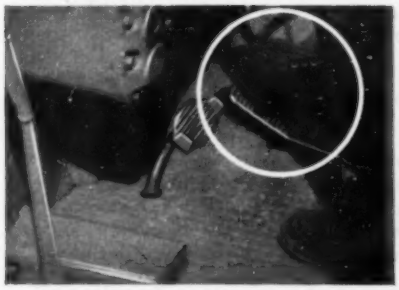
The *Forty Five* is a truly modern heavy-duty motor grader . . . designed for progress and built to *today's* standards of accuracy, dependability, operating ease and low cost. On any construction or maintenance job, you'll see all the advantages of balanced power, weight, traction and proper speeds . . . plus brand new advantages for the operator and mechanic that no other heavy-duty grader offers.

We invite you to check the features shown here. Then for the full story on the *Forty Five* — including extra-big clearances, exclusive ROLL-AWAY* moldboard, single-member tubular frame and fully enclosed power steering —see your nearby Allis-Chalmers dealer.

CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

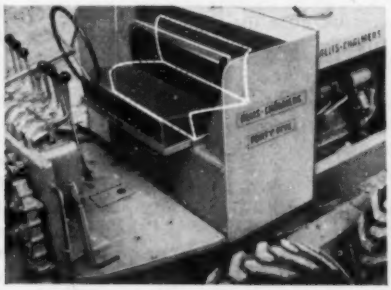
ALLIS-CHALMERS

. . . less maintenance . . . easier and better operation!

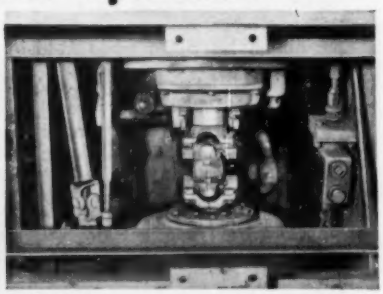


New accelerator-decelerator pedal lets the operator increase or decrease engine speed with his foot — without changing his hand throttle setting.

. . . for more details circle 179, page 16



"Box seat" comfort and visibility. Foam-rubber seat adjusts for sit-down or stand-up operation. Flat, roomy platform has tapered corners for top blade visibility.



Matchless servicing accessibility. Unit construction permits easy service or removal of clutch, transmission or engine without disturbing adjacent parts.

NEW Mack B-80 SERIES—

a money-making giant for heavy construction

New features make this rugged six-wheeler more powerful, sturdier . . . and a greater work producer than even its great Mack predecessors!

GREATER DIESEL POWER. Mack's famous Thermodyne® Diesel is now turbo-charged to 205 h.p.; other turbo-charged diesel power up to 262 h.p. is available.

MORE BRAKING POWER. Mack Thermodyne Diesel engines are recognized as having more braking power than any other. Now new exhaust brakes increase their retardation by 50%, while adding greatly to brake lining life.

NEW TRANSMISSIONS. From 10 to 20 speeds, with a wide range of options of final drive ratios to meet any operating conditions. Complete one-box units—no auxiliary transmissions or two-speed axles are necessary.

SQUARE-CUT MILITARY FENDERS. Make the Mack B-80 series look even more like the sturdy work-champions they are! Functional too—they provide strong, steady working platforms.

IMPROVED MACK BALANCED BOGIE. Assures positive traction no matter what the load or terrain. Mack's exclusive Power Divider delivers torque to each wheel in proportion to its traction, eliminating useless wheel slippage and spinning.

UNITIZED CABS. Roomier, stronger, thoroughly ventilated Mack "B" cabs are more comfortable and fully accessible. "Unitized" construction—radiator, fenders and cab mounted as integral unit at 4 points—means longer cab life, greater stability.

FULL RANGE. 11 models to choose from, giving you a complete selection of sizes and capacities to meet your own needs exactly.

You get *more* power—*greater reserve* power—to pull through with any load, on the tightest schedules when you put new Mack B-80's on your jobs. And you get all the features that you need for top efficiency and performance in the field, too! For the full story, see your Mack branch or distributor.

3471

MACK TRUCKS Empire State Building, New York 1, N. Y.

. . . for more details circle 220, page 16

Estimating Rock by Seismic Surveys

By Eugene B. Sullivan, A.M. ASCE

A consulting engineer relates his first experience with time-saving seismic methods of subsurface exploration, as utilized on a Connecticut expressway project.

THIS is a report of the experience of one engineering firm, using seismic surveys for the first time to determine rock quantities to be excavated on a section of a major new state highway.

The new highway, currently under construction, is the Greenwich-Killingly (Connecticut) Turnpike, planned as a part of a new thruway linking New York City with Boston and relieving pressure on the Merritt Parkway, Wilbur Cross Parkway, and Connecticut Route 15. Most important of all, it will be a through truck route, relieving the badly congested trucking on Route 1. Design speed is 60 mph, and all grades over 3% must have a truck lane. Maximum grades are 4%. The expressway is designed to have 2 to 4 lanes depending upon traffic anticipation.

Section 30 of the expressway, for which the firm of Loomis & Sullivan is responsible for design and supervision of construction, consists of 5.2 miles of 2-lane construction (with provision for the addition of 2 future lanes), with 7 highway bridges, 2 interchanges and 3 box culverts.

Section 30 lies within the towns of Plainfield and Killingly and joins Route 6 near the Rhode Island line. The location is all new with one small exception. Terrain is rough and mostly wooded, with many ledge outcroppings. Soils are boulder-strewn glacial till. Bedrock is a schist and gneiss formation of relatively sound quality.

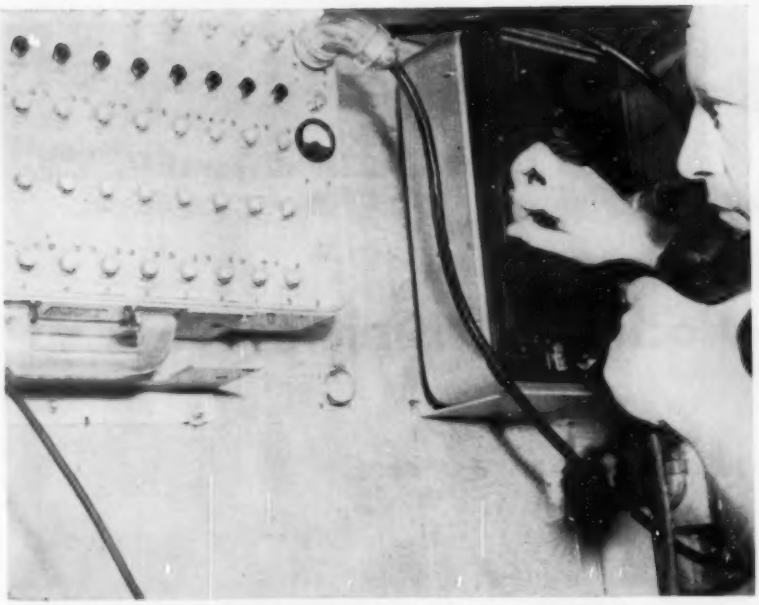
Our interest was drawn to seismic surveys by the possibility of saving time in the drawing up of sections.

The State Highway Department's approval was obtained on using the seismic method for subsurface exploration. A contract was drawn up with the 'geophysical Survey Division of Gahagan Construction Corporation, New York City. It called for allocating the sum of $12,480 covering an estimated profile length of 20,800 lin. ft., at a unit cost of 60 cents per foot of completed subsurface profile accepted by the state. Included in the price as part of the package was provision for pilot borings — at least one per 2,000 ft. of seismic profile. Bridge design locations were handled entirely by borings.

Approval from the State was grant-

(Editor's Note: The author of this article is a partner in the firm of Henry N. Loomis — Eugene B. Sullivan, Civil Engineers and Land Surveyors, Hartford, Conn. Mr. Sullivan's background includes 27 years' experience in road and bridge work as an engineer for the state of Connecticut, Director of Public Works for the town of East Hartford, Conn., and private practice on a number of multi-million dollar engineering projects.)

● Gahagan seismic equipment is mounted in a Jeep or light truck, and with cable extensions carried by hand, is extremely portable.



● Travel time of seismic waves set off at shot points is measured and recorded to the thousandth of a second by instruments, including a high speed camera (at right).

ed December 16, 1954. Notice to begin work reached the Gahagan organization on December 29. Seismic work was carried out from January 7, 1955, to January 20. Drillers were given notice on January 25 to begin work on January 31. Their work was completed on February 19. Gahagan's final report was forwarded to the engineers on March 9.

Field Procedure Outlined

The information provided gave profiles of the bedrock elevation right and left of the centerline, which permitted us to draw up definitive cross sections for every 50 ft. of highway surveyed — a total of approximately 185 cross sections. Included in the reports were characteristic velocities of materials encountered in the overburden.

For its work Gahagan mounted a portable seismic refraction unit in a 4-wheel drive Jeep station wagon. The staff covered thickly wooded ground and areas of very uneven topography. Cable extensions made it possible to traverse swampy areas and operate the equipment 1,000 ft. away from the line of profile. A 6-man crew was employed, driving 3-ft. holes with a crowbar, and using explosive charges that averaged ½ lb.

We estimate that the seismic findings made it possible to expedite planning by ⅓ the normal time. Bedrock profiles were received as fast as the seismic interpretation was completed in each area. Bedrock elevations were then plotted on the cross sections. It would have taken up to three times as long to have obtained the necessary information by other means and to correlate this information to the points of reference on the sections. In other words, the usual time required for drilling and correlation was eliminated by having the rock specifically located at the extremities of each cross section.

While the job could have been handled by borings within the sum alloted, sections would have been drawn up with much less information available. It is estimated that to have obtained, by other methods, the same information provided by the seismic method, would have cost approximately $48,000.

On the other hand, we feel that it is extremely worthwhile to make provision for pilot borings as part of the seismic contract price. This is especially helpful in the case of highly weathered and decayed rock and in areas of extreme geologic complexity.

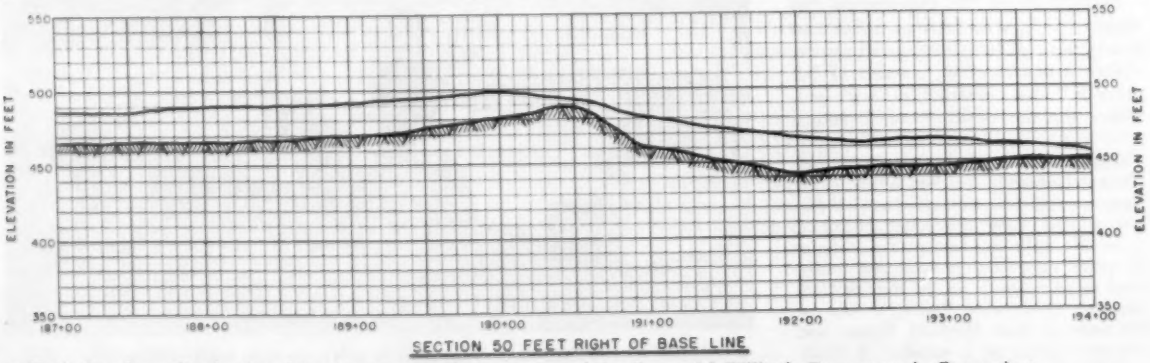
Articles and Pictures Invited from Readers

The editors of ROADS AND STREETS are interested in articles or photographs from readers on matters deemed to be of interest to fellow highway engineers, contractors and their superintendents. Complete articles preferred, but rough notes or a letter outlining facts also welcome.

Contractors: Send us job pictures and brief information on effective field methods devised by your staff, for which they should receive credit; discussion of problems and practices effecting contracting.

Engineers: Articles on technical topics, examples of progressive design, interesting projects, noteworthy plans or programs.

ROADS AND STREETS covers the planning, administration, location and design, construction, maintenance and traffic operation — of roads, streets, bridges and grade separations. Also the civil engineering end of airfield work. Accepted articles paid for.



● Typical rock profile developed by siesmic methods for section of the Greenwich-Killingly Expressway in Connecticut.

EDITORIAL

Briefly Noted . . .

It seems that contractors bidding on Virginia state highway work have been guilty of many small errors in their bids. For example, one price is shown in words and another in figures; or there are errors in multiplying the unit price by the number of units, or errors in addition.

This has caused so much trouble to the engineers that they propose to require the offending contractors, those who have two or more errors in a six months' period, to have a certified public accountant check their bids before submitting them.

This brought a holler from the Virginia Road Builders Association, who suggests that there might be a better solution. One would be to do a bit of simple double-checking of the figures. On going over the bid details a second time, the contractor might wonder why he made some of the items so low.

•

ROADS AND STREETS in November carried an article on the largest cement treated base contract ever undertaken by the California Division of Highways, or any highway agency to our knowledge. And in this issue is published a discussion of some of the highlights in California's cement stabilization experience.

It is interesting to note that California, in contrast with nearly all other states which have taken up cement stabilization, utilizes only a rather high type aggregate. The original concept of soil-cement, to use the national term for it, was to enable the utilization of soil materials in place in the road or of any low-grade materials requiring little or no haul.

The practice of cement stabilization is undergoing rapid development, and, naturally, divergent philosophies are to be expected. In any event, since material hauling is a major cost element in road construction, the possibility of processing a wide variety of relatively fine soils should not be overlooked in the employment of this construction.

It may be that cement treatment will emerge as two distinct types, one for in-place base construction for light traffic roads and one for utilization of imported or processed aggregates where a higher cost is justified as part of the roadbed design for heavier traffic.

•

Anyone who becomes stranded while driving on the new Ohio Turnpike is instructed to fasten a white handkerchief to the left front window of his car or raise the hood. Either device is a signal for a roadside service truck to come to the rescue.

It will be interesting to see what other new ideas are worked out in the near future to help motorists and truckers make better use of turnpikes. And why not with free expressways, too?

•

Freeways, expressways, call them what you will, even these can't keep motorists from killing themselves. While Los Angeles freeways have achieved a fatality record of around one per 100 million vehicle miles, the lowest in the nation, ten fatalities nevertheless occurred in a recent 4-week period. One fatal accident pictured in the news involved a tank truck which had stopped to avoid hitting another vehicle which had stopped for a flat tire. A second truck plowed into the first one.

One of the most important single safety and operational aspects of these big urban traffic streams is the handling of vehicles involved in mechanical difficulties or minor sideswipes. Possibly, prominently displayed signs should warn all drivers not to stop for tires or any emergency as long as they can get to the shoulder or nearest set-out point.

One thoughtful critic feels that four lanes in each direction are too many. And that the basic flaw in planning urban expressways is not to have them at close enough intervals.

Inherently there is something dangerous and unhealthy in a flow of 100,000 to 175,000 vehicles per day in a single traffic stream. Trouble is bound to happen in the midst of such a maelstrom.

•

A reminder that sound right-of-way acquisition methods are vital to maintaining public confidence in the highway program comes from Baltimore. According to a newspaper clipping, land for the approaches to the multi-million dollar Baltimore Harbor Tunnel is being acquired under a curious contract in which two local real estate firms split a 7½ per cent fee for handling acquisition work. This is a percentage of the price paid land owners — the more money the land owners get, the more the fee.

If this is true, the gravy train indeed has a new coat of paint. J. E. Greiner Company, consulting engineers for the tunnel, and chairman Russel H. H. McCain of the Maryland State Roads Commission, were publicly hauled over the coals in this newspaper report by a Robert Moses, New York civic figure and parkway builder, who testified before a committee of the Maryland Legislative Council.

IT COSTS LESS TO BUILD GOOD ROADS THAN TO HAVE POOR ROADS

Roads and Streets in the News

More Toll Projects Financed

• *California:* Issuance of $80,000,000 worth of revenue bonds for construction of a second bridge across the Carquinez Straits and a new span between Benicia, Solano County, and Martinez, Contra Costa County, is authorized by the California State Toll Bridge Authority.

The bonds will provide $46,000,000 for the new Carquinez Bridge, remodeling the present paralleling bridge, and constructing freeway approaches; and $34,000,000 for the Benicia-Martinez Bridge and freeway approaches. The $46,000,000 issue was expected to be offered for sale early in December; the other late in 1956.

The Authority authorized recall of $15,800,000 outstanding San Francisco-Oakland Bay Bridge bonds, due in 1971. Bonds would be redeemed by reducing the bridge's emergency reserve to the statutory minimum. The move will free $6,000,000 now and $11,000,000 next year for the state highway construction fund, particularly for northern California counties.

The Authority also approved a contract with the State Department of Finance for a $6,000,000 loan from the state school lands fund for immediate completion of the second deck of the Richmond-San Rafael Bridge.

• *Connecticut:* Completion on schedule in the next two years is forecast for the $398,000,000, 129-mile toll expressway, being constructed from the New York State line at Greenwich to the Rhode Island line at Killingly. Only $100,000,000 of the financing has been completed (revenue bond issue sold last year). Another $100,000,000 is to be offered soon.

In another Connecticut development, the Greater Hartford Bridge Commission has organized and will consider hiring engineers, with plans to issue $45,000,000 in revenue bonds for five toll spans across the Connecticut River.

• *Illinois:* In preparation for a construction start by next May 1 on the northern Illinois toll road system, the State Toll Road Commission sold $415,000,000 of revenue bonds to a 563-member underwriting syndicate headed by Glore, Forgan & Co. and Halsey, Stuart & Co. Interest on the 40-year bonds was set at 3⅝ per cent.

The sale was made despite a taxpayer suit seeking to force the Commission to finance separately each of the three routes involved, so that each would become toll-free as soon as paid for, rather than after all three were debt free. Commission officials said the suit must be disposed of before final delivery of the bonds.

Scheduled for completion by Jan. 1, 1959, with some sections to be opened earlier, the northern Illinois turnpike network will be 321.4 miles long and composed of three parts — the tri-state, the North Illinois and east-west routes.

Construction will be in two stages. The first, 193.3 miles long and financed by the bonds just sold, includes the first two routes in their entirety and a portion of the east-west route from its intersection with the tri-state to a link with US Route 30 near suburban Aurora.

• *New Jersey:* Preliminary traffic and revenue reports on proposed northward extensions of the state's two toll roads — the New Jersey Turnpike and the Garden State Parkway — were received in late October by the New Jersey Turnpike Authority and the New Jersey Highway Authority, separate agencies.

• *New York:* A syndicate headed by the Chase Manhattan Bank purchased $50,000,000 of state-guaranteed New York Thruway Authority Bonds. The sale advanced the Thruway's permanent financing to $650,000,000, of which $300,000,000 represents obligations secured only by project revenues. The Thruway's total cost is expected to top $1,000,000,000.

• *Oklahoma:* Governor Gary announced that the Oklahoma Turnpike Authority hopes to offer a $63,000,000 revenue bond issue for sale in January to finance construction of the projected 93-mile toll road north from Oklahoma City to link with the turnpike being constructed in Kansas. Actual construction would start in March.

The banking group, headed by First Boston Corp., declared, however, that before the bonds could be marketed a new traffic study and engineering report would be necessary.

Second Ohio turnpike project being studied

Surveys are being made in Ohio to determine the location and feasibility of a new fork-shaped North-South turnpike, to be designated as Ohio Turnpike Project No. 2. According to the latest thinking this would comprise a 216-mile route leading northeasterly from Cincinnati, skirting Dayton, Springfield and Columbus, and tying in with the newly announced Erie section of the Pennsylvania Turnpike at the northeastern corner of the state. A 94-mile spur would lead from the main line near Delaware, Ohio, and run north to Toledo.

While costs are not yet known, the figure of $535 to $550 million estimated in 1954 is still being bandied about. A bond flotation for the entire amount might be made about next May, should the governor approve the routes. The engineering reports are due to be completed about December 1.

Under the Ohio Turnpike Act, each turnpike project must stand on its own feet financially. The state highway department makes the preliminary studies with funds advanced by the state. The governor then selects or approves a 1-mile-wide route band, following which the final route is pin-pointed by further engineering studies.

Together with the Pennsylvania Turnpike along Lake Erie, and the Erie section of the New York State Thruway, also recently announced, this would provide a continuous nonstop toll road from Cincinnati to Buffalo (and on into New York City).

Should a $550 million bond issue be forthcoming, it will exceed the largest issues for the eastern toll projects, the $326 million issue for the east-west Ohio Turnpike, and even the $400 million flotation for the Illinois toll road currently under construction.

Cement shortage affects toll road planning

Inadequate supplies of portland cement has prompted the Indiana Toll Road Commission to investigate the possibility of completing unfinished portions of the Northern Indiana Toll Road with a flexible type bituminous (blacktop) pavement. Concrete paving work was in progress on some sections in 1955 but the big paving push

is scheduled for 1956, with 96 miles of the 156-mile dual paving job yet to be done.

The Commission by resolution requested such an inquiry be made by the J. E. Greiner Company of Baltimore, Md., engineering consultants on the Northern Indiana road.

The Commission also instructed the Greiner Company to consider the "possibility and practicability" of using the flexible bituminous type roadway on the proposed North-South Toll Road. The Greiner Company is now making the final civil engineering survey for this road which would link the northern road with the Indianapolis area.

The move was precipitated by reports of cement shortages from many contractors working on the northern road.

Sloping beveled retaining wall minimizes glare

A noteworthy design feature of the urban expressways at Austin, Texas, is an unusual retaining wall effect, aimed at cutting down noise and glare. The walls are corrugated by forming them against corrugated metal form lining. The walls have a batter ranging from .5 to 1 to .7 to 1, the bevel being adjusted for various local conditions such as height, bridge end considerations, etc.

The portion of the expressway pictured here was built in 1952 under the Texas Highway Department's urban expressway program for Austin. The contractor was Dean Skinner of Austin.

Two pavement types for Connecticut expressway

Both reinforced cement concrete pavement and bituminous concrete pavement will be used in the construction of the new cross state Connecticut expressway, it was announced by Commissioner Newman E. Argraves of the state highway department this week. Of the total of 129 miles, 68 miles will be paved with portland cement concrete and 61 miles with asphaltic bituminous concrete. The decision to use both types on different sections was announced following receipt of a legal opinion from the law firm of Storey, Thorndike, Palmer and Dodge of Boston, bond counsel for the turnpike. The opinion upheld the department's right to obtain alternative bids and use both types on the turnpike under the terms of the bond declaration and agreement.

As a result, the contract for the Milford section on which alternative bids were received was awarded to the Savin Construction Co., of East Hartford, low bidder on portland cement concrete at $5,006,528. L. G. DeFelice and Son, Inc., of New Haven, was the low bidder on the bituminous concrete type of pavement for this section, its bid being $4,728,527.

Two Minnesota highway associations to merge

The heretofore divided effort which has hampered the promotion of good roads in Minnesota is expected to be changed by the expected merger of the Minnesota Highway Federation and the Minnesota Good Roads Association.

At a meeting of the two organizations, A. C. Godward, president of the Hennepin County Good Roads Association, was elected temporary chairman of the group. The main issues for the backers of better roads in Minnesota are:

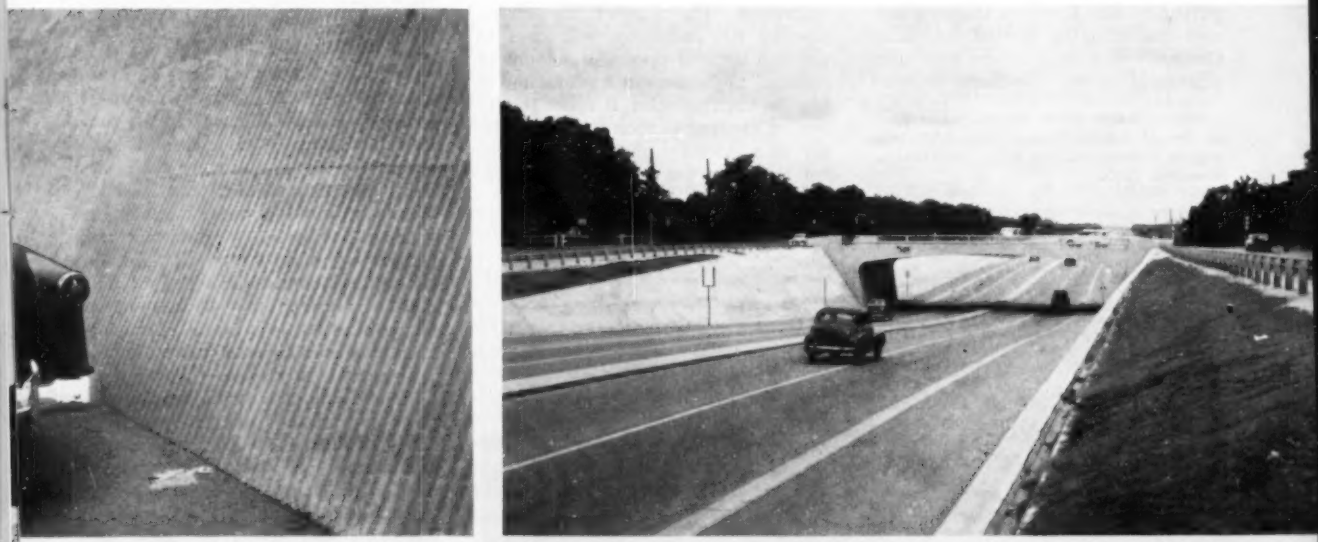
1. The passage of the state constitutional amendment which would change distribution of road user taxes between state, county and local governments; a sore point heretofore.

2. The passage of a federal program to provide financial help to the state in road building.

The state amendment passed in 1955 by the legislature, which will come up again in 1956, would distribute road user taxes 62 percent to the state, 29 percent to the counties and 9 percent to local governments. Present distribution is 80 percent to the state, 20 to the counties.

$750 million New York road bond issue defeated

Most unexpected set-back in highway financing to occur recently was the defeat by voters in November of the proposed $750 million bond issue for improving New York state highways. A 50 per cent hike in gasoline taxes was part of the deal. It had been attacked by the New York Automobile Club and some other groups, with claim that it was unconstitutional in that the measure did not call for earmarking the motor fuel tax revenues involved for highway construction purposes.



● Pleasing effect as well as eliminating glare and minimizing traffic noise are achieved by this sloping beveled retaining wall design.

California Methods and Experience in Cement-Treated Bases and Subgrades

From an article by Carl Alzueta, Assistant Engineer, Construction Department, California Division of Highways; published in "California Highway and Public Works," May-June, 1955.

CALIFORNIA specifications permit the contractor to choose between mixing the cement treated base on the road or in a plant. The road mixed method has proven most popular with the contractors since it permits a much larger daily production. In addition, road mixing is a separate operation utilizing a different type of equipment and for that reason both the base construction and bituminous plant mix can be done concurrently without the necessity for two separate plants. On certain projects because of local conditions no choice of mixing methods is permitted and the type of mixing is dictated.

The average cost of mix and compact exclusive of cost of material in 1953 was $0.21 per sq. yd.

Cement treated subgrade is completely road mixed since it is naturally adapted to this type of operation. Contractors have developed equipment trains that operate from the pavement side forms to shape, windrow and trim the treated subgrade. Cement treatment is always done after placement of the side forms because of the difficulty experienced in placing them accurately on the hardened surface.

Average cost of this treatment, exclusive of cost of material, in 1953 was $0.24 per square yard.

• *Plant Mixing.* Contractors generally elect to plant-mix cement treated base when it is to be used for shoulders, borders or ramps, or where road mixing operations may be seriously hampered by traffic. Variable width construction, in particular, is not suited to road mixing because of the difficulty encountered in proportioning and controlling the cement and water properly.

California specifications require that the aggregates be separated into two sizes, one size to consist of material passing a No. 4 sieve and the other retained on a No. 4 sieve. The exact size of the separation screen is not important as long as the finished product conforms to the above requirement. The size of the screen opening the contractor will elect to use will depend upon the amount of retained moisture and the amount of fines in the aggregate. It is not the intent of the specification to require the use of a drier for aggregate containing less than the optimum moisture. However, under certain conditions contractors may elect to dry the mineral aggregate in order to facilitate screening. In this event, heating of the aggregates is limited to not more than 150 deg. F. This will prevent flash set of the mix with a resulting loss of compaction and strength.

Where bulk cement is being used, it should be prevented from hanging up in the weigh hopper and chutes. Vibration may be provided if necessary to maintain a free flow. The mixer should be properly cleaned daily and since build up of cement and aggregate on mixer shafts, paddles, and liners is rapid, any neglect even for a short time materially reduces the capacity and efficiency of the mixer.

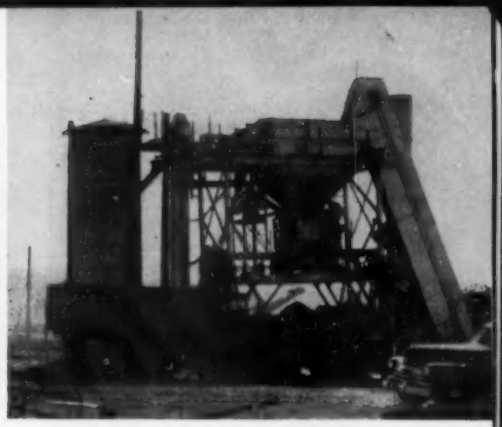
The horsepower demand in mixing this type of material is considerably more than that for a bituminous mixture. The normal practice is to space the paddles farther apart and reduce the number per shaft, but this can be overdone. If there is any question as to the efficiency of mixing, the power should be cut off at the end of the mixing period, and samples obtained from each end and the center of the mixer, and test specimens fabricated from each. Comparisons of compressive strength will serve as a check on the distribution of cement.

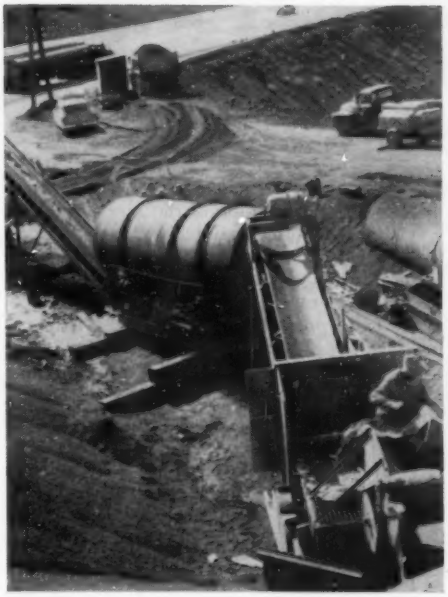
• *Mixing — Road.* Under the road-mix method it is essential that windrows of material to be treated be sized immediately prior to mixing. Where material is mixed from a blanket the depth of mixing should be checked. This is required in order to maintain a constant proportion between the cement and aggregate and to provide a uniform consistency. For similar reasons, material that is brought in for treatment should be mixed as uniformly as practicable at the source.

Cement is spread on the windrow in bags by hand or in bulk by means of a distributor truck. In dumping the bags, the cement should be spread as uniformly as possible throughout the length of windrow that the bag is to cover. Because of lower costs California contractors generally use bulk cement.

See also article "Three Mixers Abreast Process Record Cement-Treated Base Job," plus notes on California practice, ROADS AND STREETS, November, 1955.

• P&H roadmixing machine on California cement treated base.





● Some of the varied plant equipment used by contractors in centrally mixing cement treated base materials. (Left): Barber-Greene plant assembly. (Right): Unidentified mixing plant. (Below): 250-ton-per-hour plant designed by A. G. Raisch, contractor, for continuous mix flow -- consisting of belts, water tanker, and drum with mixing fins.

Accuracy in the spread of bulk cement by means of mechanical devices may be checked by laying out building paper in the "V" notch and spreading upon it, after which a measured section is gathered up and weighed. It has been found that the spread from certain distributors is influenced by the quantity of cement in the bin over the screw. When the bin is full, larger amounts of cement will be spread than desired; and when the bin is nearly empty, less cement is distributed. It is recommended that the spread be checked at various bin levels.

● *Test Specimens.* If the efficiency of mixing or distribution of cement is questioned on a project, three test specimens are taken from material from any one point along the windrow; one from each side midway in the height of the windrow, and one from the center of the bottom face. Class A and B cement treated bases and cement treated subgrade are tested by compressive strength cylinders and Class C cement treated base by stabilometer tests to indicate the degree of uniformity.

The following types of road mixers are being employed by California contractors:

1. The pugmill or auger machine that mixes from a windrow. This type is the most commonly used by the contractors.

The pugmill or auger mixers should be carefully checked to see that the material near the bottom of the windrow is being lifted from the subgrade and is receiving thorough mixing.

This type of mixer can also be easily overloaded with lower resultant uniformity of mixing. As the trend is toward thicker bases, the width of land and thickness of layer that can be mixed in a single pass must be carefully studied. The manufacturer's recommendation should be followed, and the uniformity of mixing checked periodically by methods previously described.

2. The tranverse shaft type that mixes the material by means of revolving paddles. This mixer does not require that the material be windrowed, which means less interference to traffic. On narrow mountain sections this results in a minimum of interference to traffic.

The mixer should be checked for depth and uniformity of mixing. Every effort should be made to add the cement to the mineral aggregate when the latter is dry. Balling of the cement results if the cement is placed on damp aggregates and may require excessive mixing passes to blend in uniformly.

3. The elevating mixer which combines a loader and a pugmill unit. This mixer has the advantage that it can mix large windrows of material, making it possible to treat larger quantities of material in a single pass.

● *Spreading and Compacting.* Since cement treatment hardens rapidly after compaction it is generally more difficult to obtain a satisfactory subgrade for the bituminous surfacing. Riding qualities of the bituminous pavement superimposed on a cement treated base are largely influenced by the spreading of the cement treated base, supplemented by the trimming with the self-propelled blade grader. The trimming operation is highly important and should be very carefully performed. The more care taken in the spreading, the less trimming will be necessary and less scarring of the surface will result.

Strength of cement-treated materials is largely dependent on the density obtained. To insure good compaction, it is essential that the base be compacted as soon as possible after

● Dry mixing cement with Seaman pulverizing mixer for cement treated base.

the material is mixed. Sufficient moisture must be present in the mix to provide lubrication and maximum density. Slightly more than this amount will result in spongy spots during the rolling. Best results are generally obtained with a moisture content just short of instability or "quaking" under a roller.

If a motor grader is used to spread the cement treated base, it is recommended that a roller be used after the first pass of the grader in order to remove the tire tracks immediately. If the tracks are filled in before rolling, they contain more material than the adjacent areas, resulting in an irregular section and uneven compaction.

Between the operations of compaction and finish surface rolling the surface is trimmed where necessary with a blade grader and the cut material wasted.

Shaping or blading after spreading has been found undesirable as it develops horizontal planes, or laminations, in the material. Every effort should be made to make the initial spread smooth and uniform.

The trimming should be done before the cement treated base has hardened in order to reduce surface tearing to a minimum. A pneumatic-tired roller with a water spray bar provides the final compaction and a close-knit texture to the surface

● *Thickness of Layer.* Cement treated bases should never be placed in layers less than 4 inches in thickness. Thinner layers laminate and may develop slippage between the planes.

● *Surface Texture.* There have been instances where the bituminous surfacing placed on cement treated bases has slipped because of a smooth slick base surface texture. This condition is usually encountered with fine-grained materials such as sand or disintegrated granite which are lacking in large particles. Under such conditions consideration should be given to roughening the surface texture by means of a sheepsfoot tamper or other such roller. Tractor cleats should be avoided since they tear the surface.

● *Curing Seals.* Except for Class C cement treated bases, the surface of these treatments are kept moist until the application of the asphaltic emulsion curing seal. Class C cement treated base which has no compressive strength requirement generally does not receive a curing seal and is usually primed as in the case of any untreated base.

Bituminous membranes are applied to cement treated bases for the following purposes:

1. To retain moisture during the curing period.
2. To protect the surface under the action of traffic.
3. To provide a tack coat for bituminous surfacing.

An MC-2 curing seal is added to cement treated subgrade not only for the first two purposes but also (and primarily) to toughen the surface and provide additional resistance to erosion.

● *Traffic Through Construction.* It is considered advisable to close cement treated bases to traffic for a period of seven days of curing; however, this is not always practicable, and the specifications permit immediate use when necessary.

Every effort should be made, however, to keep traffic off of the new base until it has developed sufficient slab strength to resist breaking up under the traffic loads. This is of particular importance during fall, winter and early spring construction seasons when excess moisture may cause a yielding subbase.

Class A and B cement treated bases, if placed on yielding subbases and subjected to traffic before they have developed sufficient slab strength, may break up and defeat the purpose of the treatment. This condition, if it occurs, can lead to ultimate failure of the section.

Where heavy traffic must be carried over cement treated bases for long periods, provision must be made to protect the surface. Curing seals are helpful in providing this protection, and in the more extreme cases consideration is given to the use of MC-2 instead of the emulsion generally specified. The greater penetration of MC-2 provides a better wearing course and lessens the surface abrasion. Where traffic must be carried throughout the winter over a base without the surface cover, it may be advisable to tailgate a ¾-inch to 1-inch mat of bituminous mix material for a temporary wearing course.

California began its first cement treatment of soils in 1921. The operation was slow in being adopted and it was not until 1938 that cement treatments were included on contract work. Today in California cement treatments have progressed to the point where it is unusual to review a set of plans without some type of cement stabilization.

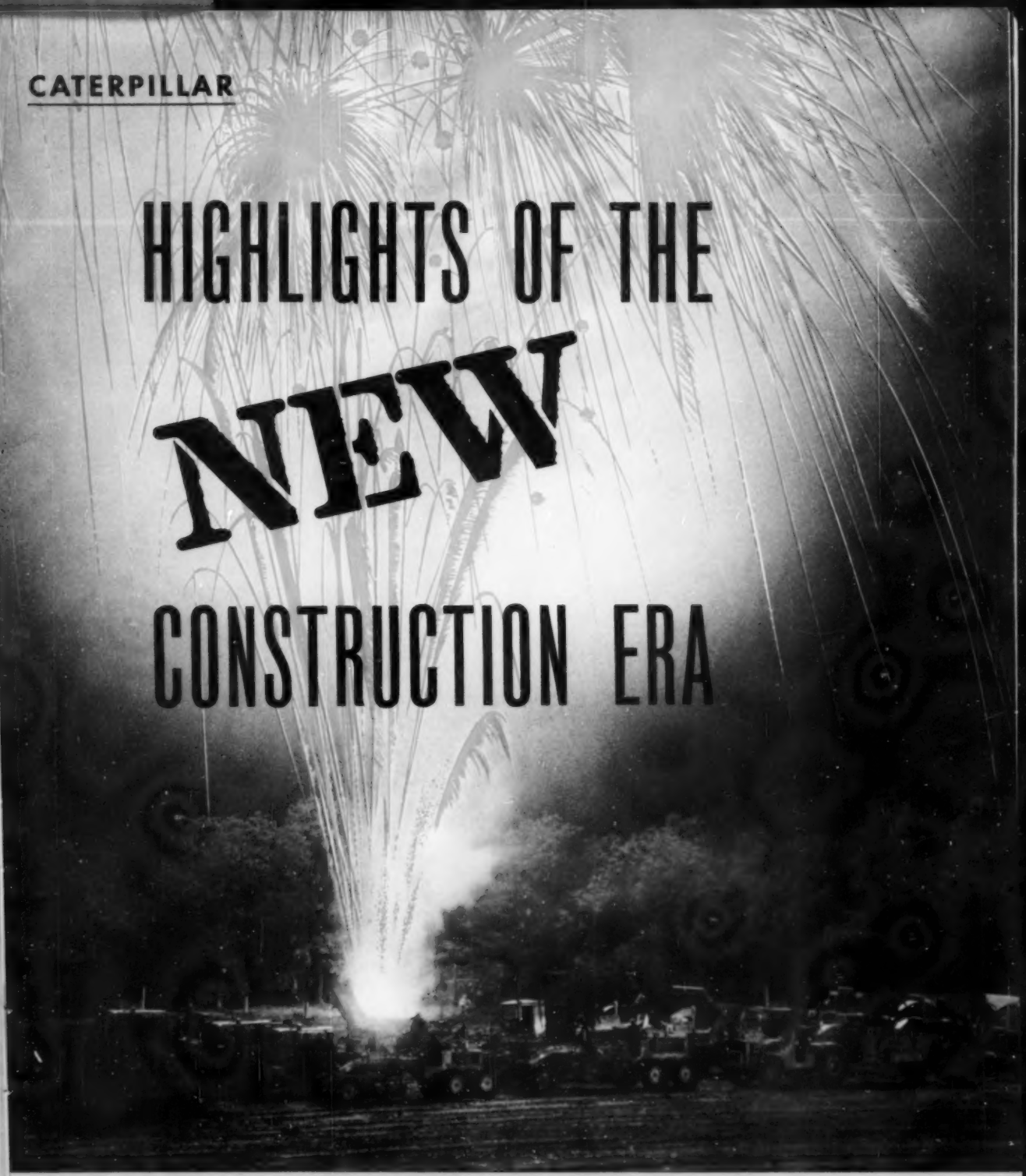
Cement treatments offer the highway engineer the advantage of a base with increased supporting power of positive insurance against the bad effects of inadvertently including non-uniform base material. The use of increased cement must, of course, be balanced against the possible adverse effects resulting from loss of pavement flexibility.

● Large capacity spreader for use with bulldozer in spreading pre-mixed cement treated base materials.

● Hercules spreader spreading portland cement prior to mixing by Seaman mixer.

CATERPILLAR

HIGHLIGHTS OF THE NEW CONSTRUCTION ERA



Never before in history has the equipment industry faced such a tremendous challenge as today. We are entering what might well be called the "construction era." Right now construction is the greatest single factor in our industrial economy, employing 12% of our total labor force. And construction can never move forward by itself. Its progress is dependent upon increased production in mines and forests, cement mills and steel plants. Caterpillar Tractor Co. is matching these new opportunities with an array of new products that will increase production, cut maintenance costs, work longer and more profitably than any other equipment on the market. These Caterpillar-built products are the result of continuing research in the laboratory and in the field. They are forceful evidence of Caterpillar Leadership in Action. See them on the following pages.

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The new D9

This new giant is a bear for work. Choice of torque converter or exclusive oil clutch drive. First track-type tractor with Turbocharger. Completely new 286 HP engine. "Live-shaft" drive for rear-mounted equipment. Many other important features.

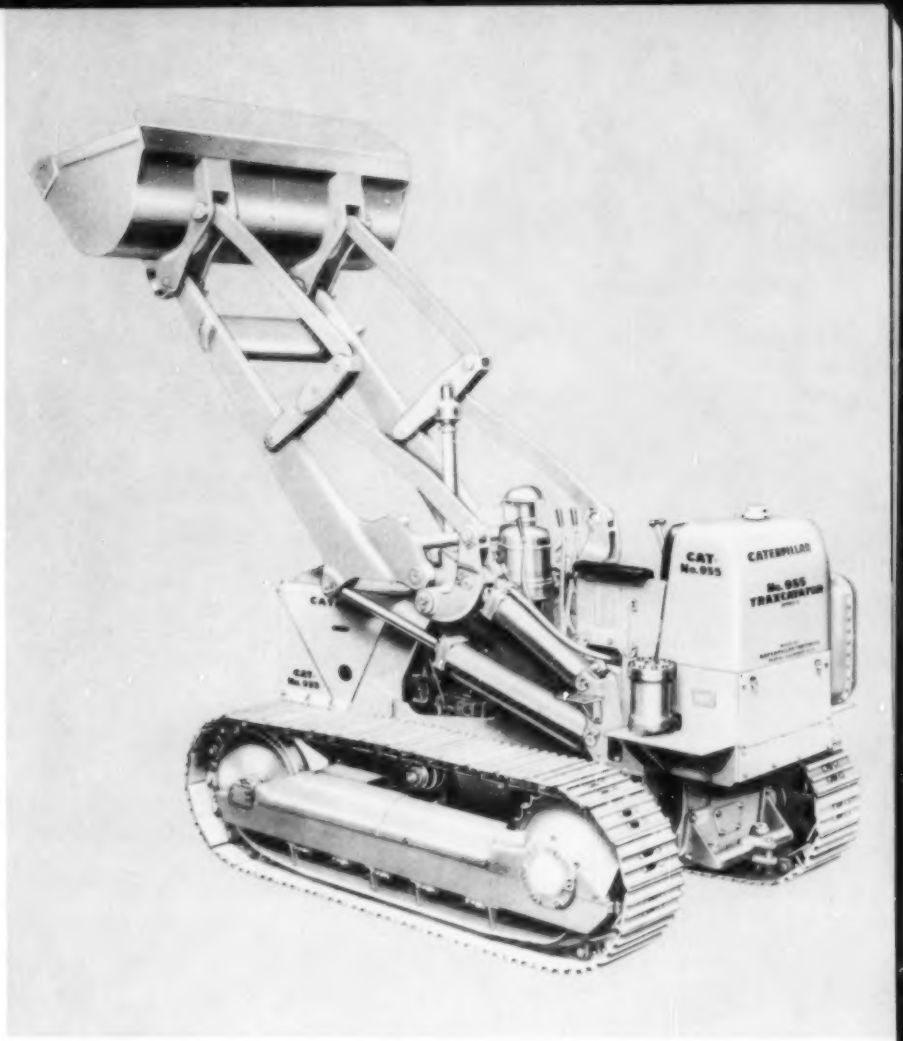
The new D8

With torque converter (Series D) or direct drive (Series E). Completely new 191 HP engine. "Live-shaft" drive for rear-mounted equipment independent of flywheel clutch. New easy controls. Many other improvements. Shown with new Cat No. 463 LOWBOWL Scraper.

The new D7 (Series C)

New 128 HP engine. Drawbar pull 28,700 lb. maximum. Exclusive oil clutch. Finger-tip steering. New starting engine for easier operation. Track shoes hardened by "*water quench*" process (also on D8 and D9). Many other important advances.

LEADERSHIP IN ACTION



No. 955—1½-yard capacity

Balanced for bigger production at lower cost. Major features: 40-degree bucket tip-back at ground level, new oil-type clutch, convenient lift and dump levers, modern hydraulic system, high reach, "designed in" operator comfort, optional starting and versatile attachments.

NEW in Traxcavators!

No. 933—1-yard capacity

Like its bigger brother, *balanced* to outproduce ordinary tractor-shovels of equivalent capacity. Also backed by *one* manufacturer to provide you the advantages of single manufacturing responsibility and one service source. Major features—same as the No. 955!

LEADERSHIP IN ACTION

NEW in wheel-type tractors!

The new DW21 Tractor ▲

(Series C.) New 300 HP Caterpillar Engine with Turbocharger. 10% more rimpull. New No. 470 LOWBOWL Scraper. 18 cubic yards struck, 25 cubic yards heaped capacity. New, wide-section 29.5-29 tires give big-footprint flotation and maximum traction. Many other new, thoroughly tested features.

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The new DW20 Tractor

(Series E.) Shown with new No. 456 LOWBOWL Scraper. This great new team highballs up to 32.1 MPH for fast cycle times. Same 300 HP engine with Turbocharger and wide-section tires as DW21. LOWBOWL design loads more material in less time by using tractor and pusher power at maximum efficiency.

LEADERSHIP IN ACTION

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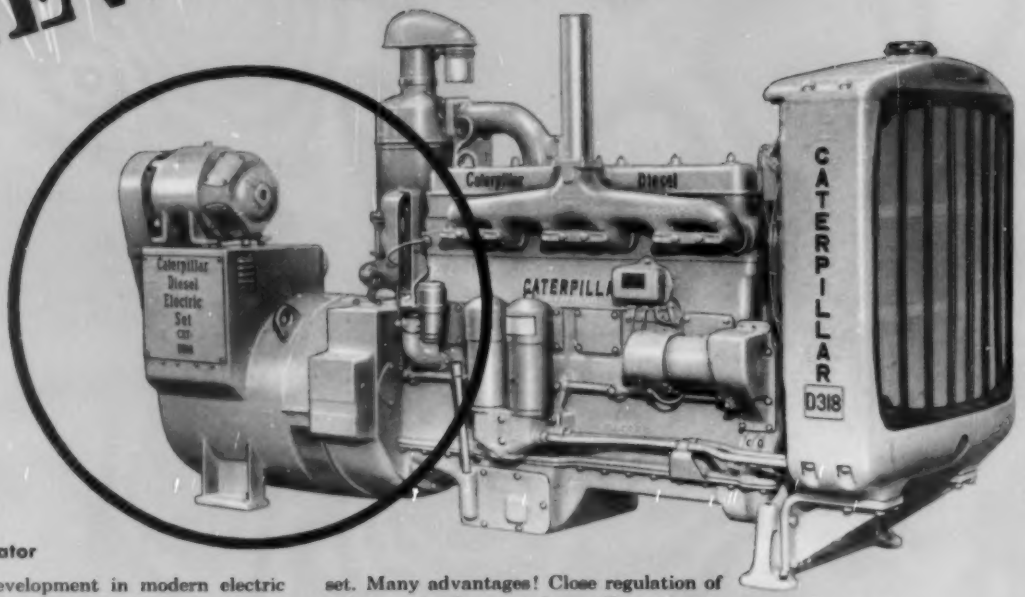
The new No. 12 with oil clutch

With the addition of the job-proven oil clutch, the big, versatile No. 12 Motor Grader gives you more economy and efficiency than ever. The new clutch increases work life since the constant oil bath lubrication reduces wear on all moving parts. There is less maintenance; 1500 hours without adjustment is not unusual and no external lubrication is needed. The new No. 12 is more efficient because the clutch is constantly cooled, eliminating clutch fade and slippage due to overheating.

LEADERSHIP IN ACTION

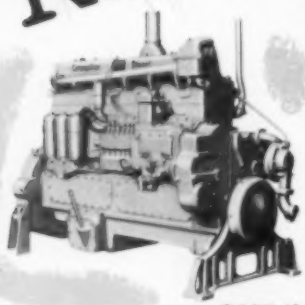
NEW in generators!



Cat Generator

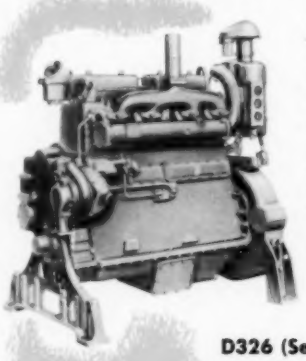
A major development in modern electric power. Brings to Caterpillar's new line of Diesel Electric Sets the efficiency of the externally-regulated set in a self-regulated set. Many advantages! Close regulation of voltage, simple control, excellent motor-starting ability, easy hook-up with other generators . . . 100% backed by Caterpillar.

NEW in diesel engines!



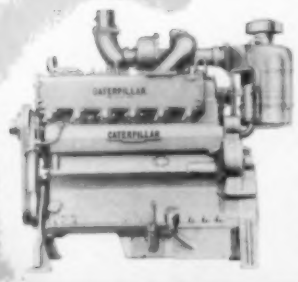
D342—210 HP maximum @ 1200 RPM

Incorporates the latest advances in modern, compact, heavy-duty diesel design. Offers better operation, less maintenance, higher horsepower. Choice of 3 starting systems—air, electric, gasoline. Like all Caterpillar Engines, burns wide range of fuels without fouling.



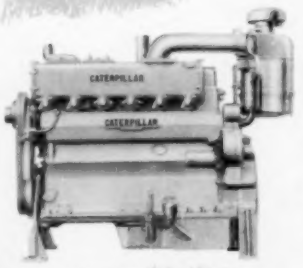
D339—140 HP maximum @ 1200 RPM

Combines new compactness with greater efficiency, economy and higher horsepower. A modern, heavy-duty 4-cylinder unit with new smoothness of operation. Choice of 3 starting systems. Many other advantages, including full-flow filtering system.



D337 (Series F) with Turbocharger 310 HP maximum @ 2000 RPM

New Turbocharger utilizes exhaust heat to drive supercharger, delivers air in proportion to engine's need. New hydraulic valve lifters practically eliminate adjustment, provide quiet operation. Greater displacement for more power. Choice of 3 starting systems. Available as Electric Sets and Industrial Engines with complete line of attachments.



D326 (Series F)—200 HP maximum @ 2000 RPM

Like other new, heavy-duty Cat Diesels, offers you more for your money than any engine in its power range. Many major features, including hydraulic valve lifters and full-flow filtering. Greater displacement for more power. Choice of 3 starting systems. Available as Electric Sets and Industrial Engines with complete line of attachments.

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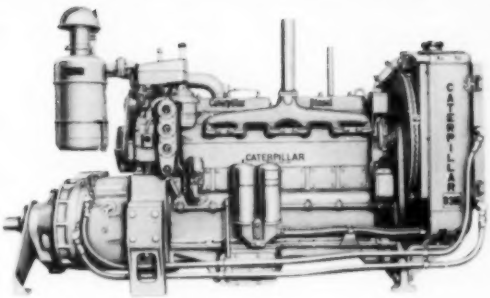
Caterpillar now offers a wide choice of torque converter power units in standard packages. Torque output is automatically matched to load for smooth load starts or control of load without use of clutch. Overloads can't kill engine. Your Caterpillar Dealer can supply these units. He also has full facilities and parts for service.



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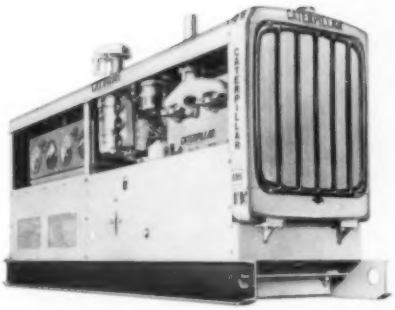
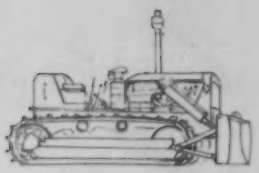
The new Caterpillar Twin Arc-Welder provides one engine, one base, and TWO 300-ampere welding generators. Four-cycle Cat Diesel picks up load instantly without missing or injector trouble. Compact design cuts transport and maintenance cost. Operators can weld at different voltages at same time. Single (3 KW) exciter cuts weight and size, provides ample excitation plus plenty of 115-V. DC for auxiliary tools.



NEW in portable electric sets!

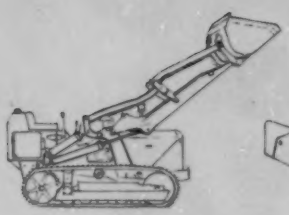
Cat Portable Electric Sets are now available in nine models, 30 to 315 KW, and in all usual voltages, 50 to 60 cycle. They're complete units with cooling system, fuel tank and switchgear, mounted on skids, semi-trailer or full trailer. Easy to hook up and operate, ready to work anywhere.

LEADERSHIP IN ACTION

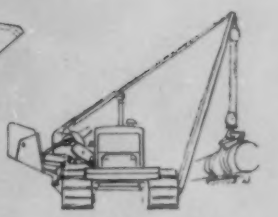


TRACK-TYPE TRACTORS

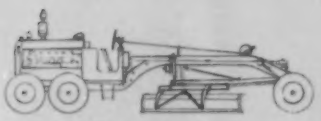
WHEEL-TYPE TRACTORS



TRAXCAVATORS



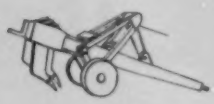
PIPELAYERS



MOTOR GRADERS

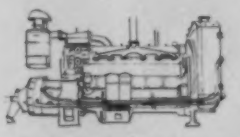
SCRAPERS

BULLDOZERS

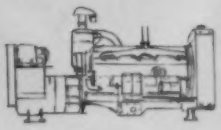


RIPPERS

INDUSTRIAL ENGINES



TORQUE CONVERTERS



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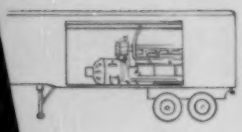
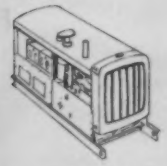


PORTABLE ELECTRIC SETS



WELDERS

Year after year you have seen the results of Caterpillar leadership. It is always in action. It never stands still. The full resources of Caterpillar research, both in the laboratory and right in the field with you, are constantly devoted to improving products and developing new ones. This means that Caterpillar is your partner in progress, bringing you better and better products, greater opportunities for profitable work. Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

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LEADERSHIP IN ACTION

PRINTED IN U. S. A.

● Site of 90-foot cut in early stages, with Bucyrus-Erie 88-B shovel on the hill.

"When You Can Drive It In a Jeep, You Have It Made"

Construction methods and problems on a pair of turnpike contracts involving 1,500,000 cubic yards of rock and 2,700,000 cubic yards of earth excavation — plus woes from hurricane and flood which cost S. J. Groves & Sons Company hundreds of thousands of yards of production.

POWER on all axles of jeeps and service rigs was a "must" in planning this mountain road job. So were push tractors and towing cables for steep, slippery haul roads in the early stages. But hurricanes and flood washouts weren't in the calculations when S. J. Groves & Sons Company took contract sections 030 and 031 on the Massachusetts Turnpike.

Located in the Berkshires west of Springfield, this twin project 13.3 miles in combined length is perhaps the heaviest of the current roadbuilding jobs in Eastern U.S., and certainly one of the most heavily equipped. It is noteworthy also for some of its engineering aspects, as will be mentioned. The twin contracts are part of the 123-mile-long string of 29 "package" contracts for

A Roads and Streets Staff Report

● Front-wheel-drive Ford F-600 specially equipped as grease truck for the Massachusetts Turnpike job.

All-Wheel-Drive a Must on All Service Roads

● One of several Dodge Power Wagons, toting fuel up to the advance compressor station.

● Another Ford equipped with Marmon-Herrington dual drive and front drive, used as fuel truck by the Groves organization.

● Tire service truck used by General distributor, also an all-wheel-drive rig from Army days.

this turnpike which will be completed in 1956 from Boston's outskirts to the New York State line.

Contract 030 while only 4.86 miles in length had 1,300,000 cu. yd. of rock excavation, largely in three big cuts, and 800,000 cu. yd. of earth excavation. This job was awarded in March, 1955, at $4,800,000 including two major structures and the 1956 season's paving. While digging in, Groves bid the adjoining 8.48-mile section 031, which had an entirely different complex of 1,900,000 cu. yd. of earth excavation and a minor amount of rock. This job with its three structures and paving was awarded late in May at $4,513,000.

● *Getting Started.* The equipment problem was an interesting one for the Groves organization, which in early 1955 was either winding up, building or bidding on turnpikes, highways and other jobs in seven or eight states. From the Groves eastern equipment pool, equipment was brought in by rail or trailer to fit the 030 rock job, and much of the clearing was done and 30,000 cu. yd. of rock was moved by late May when the neighboring 031 contract was awarded. While 031 called predominantly for tractor-drawn scrapers, in contrast, the two contracts were fused together under a single management with obvious advantages in utilization of equipment and personnel.

The methods and problems here described are chiefly related to the rock job (contract 030), where Groves concentrated effort during most of the 1955 season. Work began on a single-shift basis, building up slowly at first due to the steep haul roads. In May the company went to double-shift, using a Caterpillar 30 kw floodlight unit, two General Electric 16 kw's and numerous Kohler 5 kw or 1½ kw units. The June yardage totaled 170,000 cu. yd. of earth and 157,000 cu. yd. of rock.

By this time the company was moving rock on contract 030 at eight locations using 2 Bucyrus-Erie 88-B 4-¾ yd. shovels, 2 Bucyrus-Erie 54-B's (2½-yd.) and 3 Northwest 80D's (2½-yd.), along with cranes and backhoe for miscellaneous work. Going to two 10-hour shifts with some of the drills and shovels paid off to the tune of 141,000 cu. yd. of earth and 297,000 cu. yd. of rock during July. Twenty-six Euclid end-dumps handled this material.

Then came the August hurricane and a 29-inch (4-day) rain which destroyed whole sections of the adjoining public highway used for access, ruined ramps and haul roads, and stopped all work for many days. Despite conditions, the August estimate was 169,000 cu. yd. of rock and earth.

September was "recovery" month, and then again in October an almost unprecedented "extra tropical" storm dropped 14 in. of rain on the job, once more halting production. An almost unbelievable 55 inches of rainfall occurred in this locality between August 1 and Oct. 20, compared with about 10 inches normal for this period. (The season here has demonstrated afresh the importance of the contingency item which every sound contractor tries to figure in his bid. Even normal contingency, however, fails to cover catastrophies. Editor).

● *Haul Road Problems.* In getting the job through the early stages, with the great differences in elevation involved, the contractor chose to use relatively steep haul roads rather than circuitous ones, with the help of pusher service and towing cables. The haul road conditions have been complicated by the prevalence of mica-schist rock, which breaks down rapidly under tires to form a fluffy, slippery carpet affording little traction.

● *Front Drive.* Foreseeing this problem the contractor adopted a policy of having only all-wheel-drive equipment for service trucks, Jeeps and other supervisory or forward-area

● Up she goes! Euclid rear-dump needed help on this steep, slippery carpet of mica schist flakes. Cat D8 with tow cable took time out from dozer work when needed.

A Few of the Contract Details

S. J. Groves & Sons pair of jobs on Massachusetts Turnpike

Item	Contract 030	Contract 031
Length (mi.)	4.86	8.48
Earth exca. (c.y.)	885,000	1,840,000
Rock exca. (c.y.)	1,300,000	195,000
Clearing (acres)	140	270
Crushed stone base (t.)	59,000	107,800
Asphalt for pen. (gal.)	348,000	625,000
Asphalt conc. pavement	36,600	69,100
Major structures	2	3
Contract price ($)	4,800,000	4,513,000
Award date	March 24, 1955	June 9, 1955
Completion date	June 1, 1956	August 31, 1956

International distributor delivers...

500 TD-24's

For pioneering and road building in the rugged northwest

Howard-Cooper Corporation, one of International's 31 Western area distributors, have just delivered their *500th TD-24!*

You see this big 200 bhp crawler already at work for Wooley Logging Company, Drain, Oregon.

In rough, tough, Pacific Coast, big-scale logging, mining, and earthmoving, profitable production depends upon positive load-control, up-grade or down. *The TD-24 is the only tractor built that has planet-power steering—which gives you constant load control on both tracks when turning.* That's why the TD-24 out-produces the others so decisively, with dozer, arch, or scraper! Another big TD-24 advantage is its built-for-the-West construction. Records, on fleet after fleet, prove that TD-24's stand up under the toughest conditions—and consistently cost less for maintenance than any other make on tracks! TD-24 high-altitude performance is a big advantage, too—so is its seconds-fast, cold-weather starting and operating ease!

Oregon's 500th TD-24 is already at work. Here, it clears trees and stumps for a new, main truck-haul road near Brush Creek. "I like its torque converter," says Operator Dean Russum. "You get more power without track slippage and you no longer rough up the machine with shock loads."

TD-24's

6 for A. J. Orlando on Massachusetts Turnpike—Most of the tractor work on this Whiteside (N.Y.) contractor's 4.89-mile, 2,500,000-yard, $3,340,000 section of the Massachusetts Turnpike is being done by TD-24's. One pushing 3 scrapers accounts for 4,500 pay yards every 10 hours (scrapers on 1,500-ft. one-way hauls). Others pull rippers, level fills, etc.

If you're in the market for a big tractor, you owe it to yourself to check the leader . . . the International TD-24. Five-hundred owners in just one area have proved it their "Best Buy." If it can so successfully and so profitably lick the tough rock, cold weather, and mountain grades of Oregon, it can successfully and profitably lick your high-cost jobs, too! Let us prove its advantages with a demonstration. Call to arrange time and place.

PAY OFF ACROSS THE COUNTRY

6 for J. D. Armstrong on Kansas Turnpike—Of their 9 TD-24's, this Ames (Iowa) contractor reports all have run 5,000 hours or more before needing any repair work. Six on 1.7-mile, million-yard Turnpike section near Emporia, are towing 50-ton rollers, pulling and push-loading scrapers. On hauls of 700 to 2500 ft., they account for 5,000 pay yds. per day.

2 for J. W. Moorman on Buford Dam, Georgia—These "24's", two of the five now owned by Moorman, push-loaded scrapers or pulled 50-ton rubber-tired rollers, 18 hours every day for 18 months. On compaction, they averaged 180,000 cubic yards weekly for the 200-ft.-high, 1630-ft.-long main dam. Moorman's other TD-24's are used to push-load scrapers, and pull or push belt loaders.

3 stripping overburden for Meyer Bros., Pennsylvania—"Proven crawlers," says Partner George Meyer of his TD-24's. "We've used our 3 for 3 years now. They have good balance plus unmatched push power." Right now, rigs are removing 30 feet of shale and clay to uncover a 30-inch vein of bituminous coal. The 2 TD-24's do 80% of the job; a large shovel, 20%.

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PAYSCRAPERS
13 yds. and 16½ yds.

WHEEL TRACTORS
6 Models . . . . 9 to 59 dbp

CRAWLER TRACTORS
6 Models . . . . 40 to 200 hp

DIESEL, GAS ENGINES
16 Models. 16½ to 200 hp

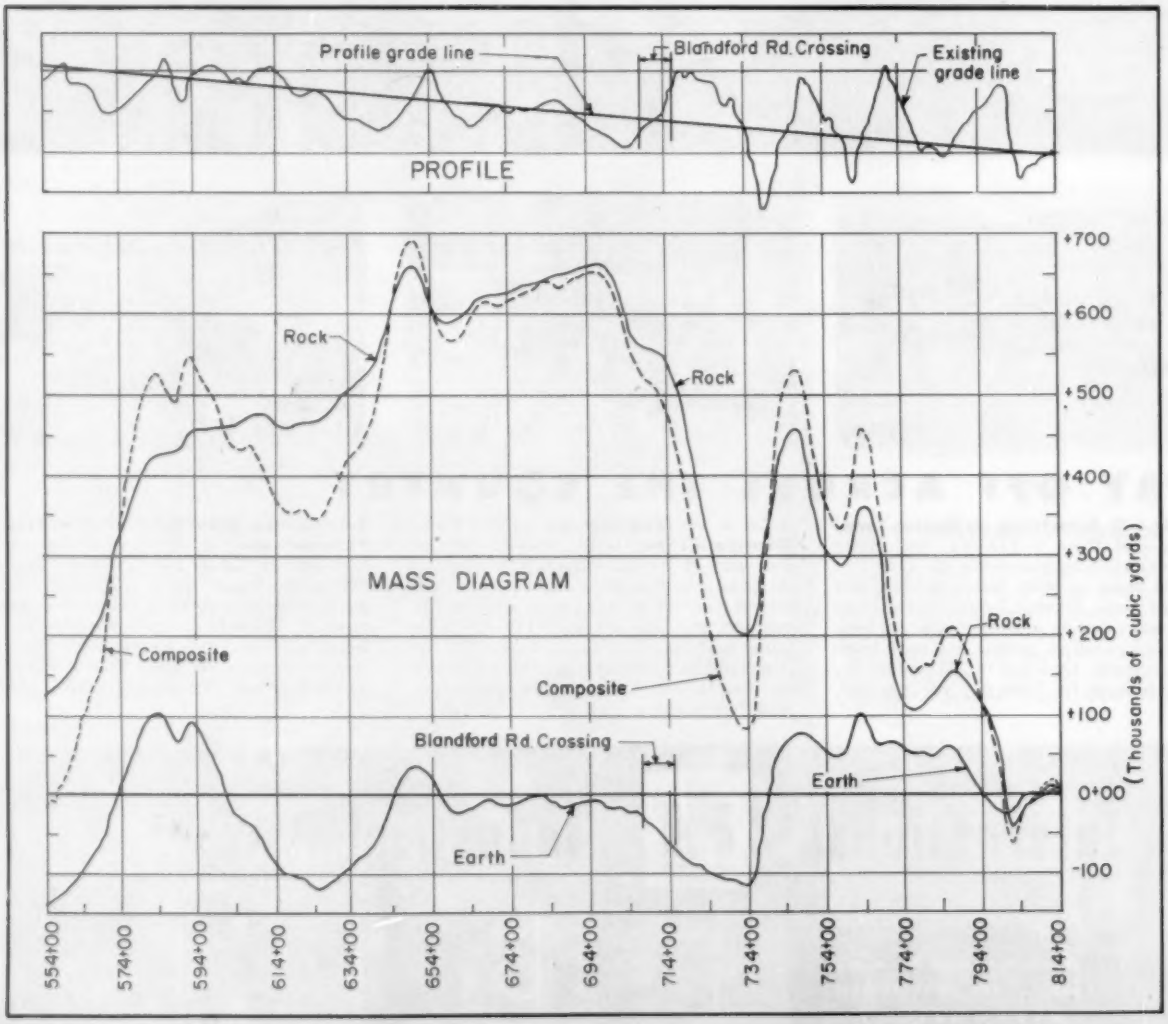
ALSO: International Drott Loaders . . . International Scrapers, Bottom-Dump Wagons . . . and International Superior Pipe-Boom Tractors.

. . . for more details circle 209, page 16

● Field shop of S. J. Groves & Sons Company is a spacious Butlee aluminum sectional building. Note mast which serves a General Electric radio-telephone hook-up to jeeps and supervisory cars.

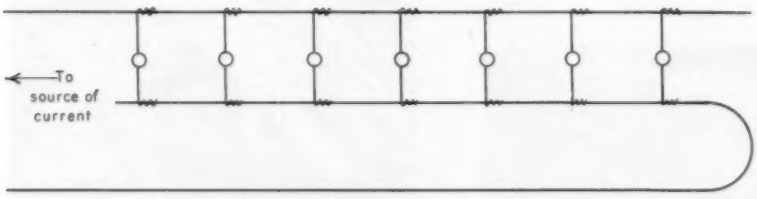
equipment. To this end, the firm brought in several Dodge Power Wagons for general roustabout work, such as delivery of cable, towing compressors, etc. Fuel supply trucks and a new heavy-duty grease truck are Ford F-500 and F-600 10-tired units having Marmon-Herrington dual drives and front drives.

● *Special Lube Truck.* A source of pride is the company's specially designed heavy-duty lube truck. It houses a Grayco pressure lubricating system, with hose reels for motor oil, gear lubricant, high pressure greasing (two lines), diesel engine oil and air. D-A lubricants are used. Equipment also includes a Westinghouse 2-cyl. 10-hp compressor; air tank at 125 psi for forcing grease, gravity water tank (located high in the back end); and hand grease guns. This unit while quite large, proved able to reach any



● Profile and mass diagram of the 4.8-mile contract section 030.

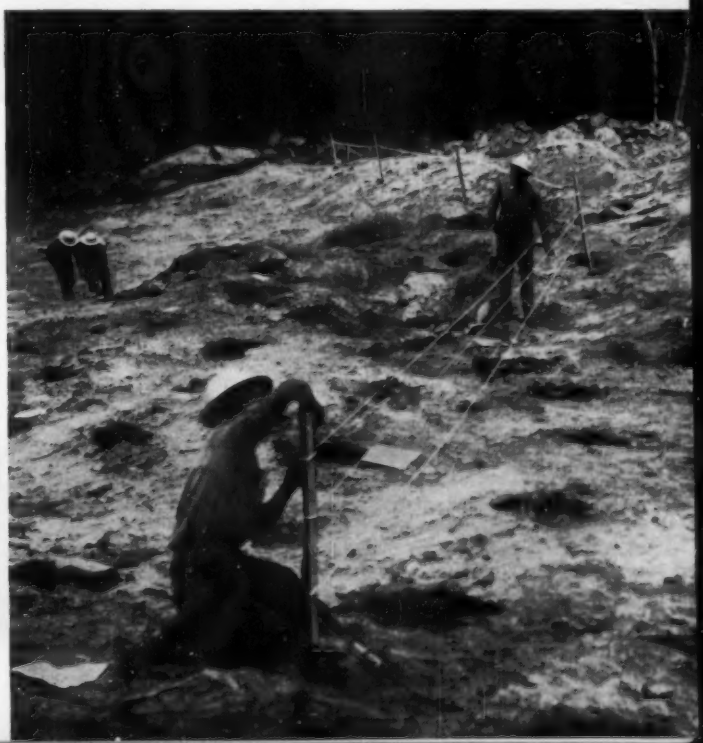
● In one of the deeper cuts. Toe drilling at various angles being done with the 3-in. Air-Trac's.



● Diagram of bus wire hook-up used by the Groves blasting foreman.

● Power wagon marked "Explosives" delivered blasting materials to forward areas.

● Blasting crew erecting bus wires (see diagram). Wires at right are being mounted on posts; those above, fastened through knife clefts in powder cartons.



Drilling and Shooting— 1,500,000 C.Y.

● Air Trac mounted Gardner-Denver drills with 3-in. or larger bits proved their value in the big cuts.

● Some of the 1¼-in.-hexagonal drill steel used with the continuous boring of deep holes, utilizing tungsten carbide insert bits.

● Serving a 4½-yd. shovel, four Ingersoll-Rand Gyro-Flo 600 compressors.

● Secondary breakage on the grade, done with a Lima Paymaster crane and drop ball.

equipment except that up on pioneer trails.

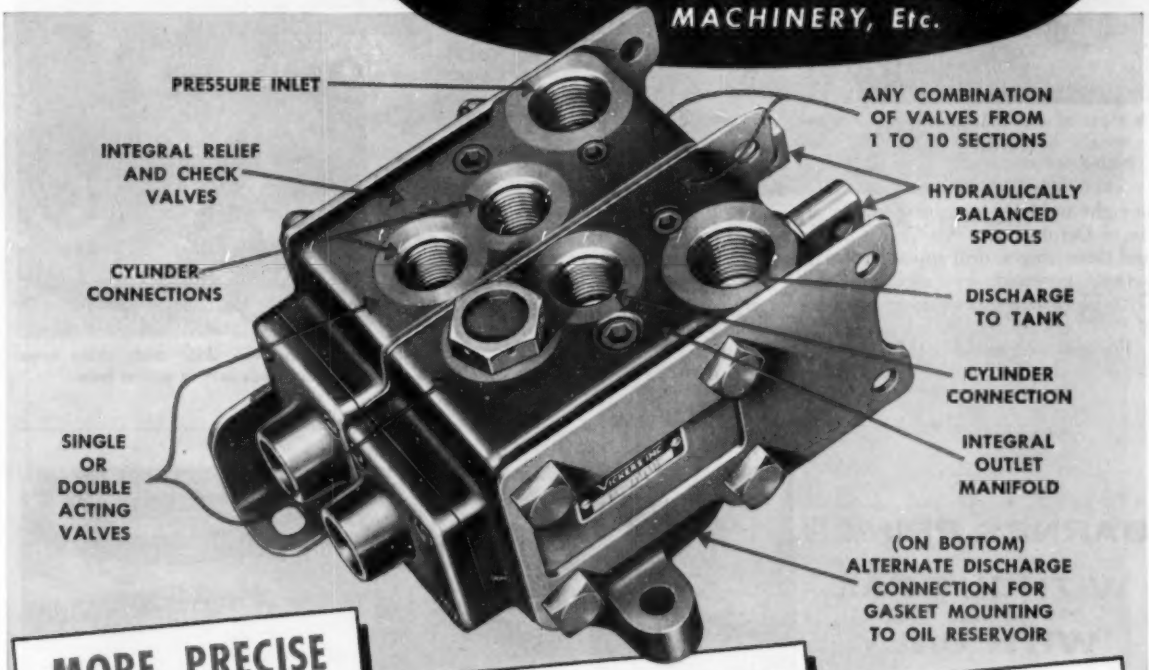
Off-road tires for the project are being serviced, handled, exchanged and repaired under a contract with Pittsfield Retread and Tire Co., a General dealer. This firm has a special all-wheel-drive tire-carrier truck.

On projects of this kind, there is the discouraging early period of getting in, followed by the slow building up on pay yardage. Then, as project manager Sam Day puts it, "When you can drive it in a Jeep, you have it made!"

● *Drilling.* The varied mica-schist and granite have required the usual experimentation. The company began with 19 Gardner-Denver wagon drills and also tried the new 3-in. Air Trac mounted Gardner-Denvers, bringing

NEW! Series CM11 VICKERS® MULTIPLE UNIT VALVES

For MATERIALS HANDLING EQUIPMENT, FARM TRACTORS, BUCKET LOADERS, CONSTRUCTION and MINING MACHINERY, Etc.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INTEGRAL RELIEF AND CHECK VALVES
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SINGLE OR DOUBLE ACTING VALVES
ANY COMBINATION OF VALVES FROM 1 TO 10 SECTIONS
HYDRAULICALLY BALANCED SPOOLS
DISCHARGE TO TANK
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INTEGRAL OUTLET MANIFOLD
(ON BOTTOM) ALTERNATE DISCHARGE CONNECTION FOR GASKET MOUNTING TO OIL RESERVOIR

MORE PRECISE CONTROL
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REQUIRES LESS SPACE
New Combination Operating-Valve and End-Plate Sections

LOWER COST
Simplified Design and Construction

New, compact, more versatile design of valve. End sections combine in one casting the inlet or outlet manifold plate together with any operating-valve section. Inlet section also contains relief valve. Individual outlet plates available for single unit valves. Single- and double-operating valve sections can be added between end sections as needed. Valve can be adapted for tandem (series) operation. Single-acting valves available for either direction of lever shift.

Other features include protection of pump from reverse flow during shifting . . . three point mounting for more simple installation . . . cylinder connections with ¾-16 N.F.-2 straight threads (AND 10050 type) which conform to SAE standards help insure leak-proof connections . . . optional outlet ports in end section so valve can be gasket mounted to the oil reservoir or pipe connected. Designed for use with Vickers Series V-200 Vane Pumps (up to 11 gpm), the CM11 Valve can be used up to 2000 psi working pressure. For further information write for Installation Drawing M168643.

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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

. . . for more details circle 236, page 16

● Some of the 4-in. air pipe was lightweight Bridgeport aluminum, with high-speed couplings.

in eight and later increasing to twelve. As of October, two Air Trac spreads and three wagon drill spreads were in action, powered by Ingersoll-Rand Gyro-Flo 600 compressors in batteries of four or less.

For the wagon drills the company began with plain steel bits of 2¾ in. or smaller size. Prevailing hole patterns of 4x4 or 5x5 ft. have brought a satisfactory yield.

For the Air Tracs bits of 3¼ or 3½ in. size were used at first, with 10x10 hole spacing designed to get an economical powder factor. This resulted in poor fragmentation and much secondary drilling. So the firm went to 3-in. bits and closed up the hole spacing to 8 or 8½ ft. patterns, with better results.

Tungsten carbide Timken bits have proved their economy in this rock. Bits are sharpened in a roofed field station using an Ingersoll-Rand air-powered grinder. In one typical operation, the grinder operator was sharpening 40 to 50 bits per day for supplying two 10-hour shifts, keeping a cycle of 60 of these bits rotating to maintain the 12 Air Tracs in operation. Bits were lasting up to 2500 hours, but required sharpening every 175 to 200 hours.

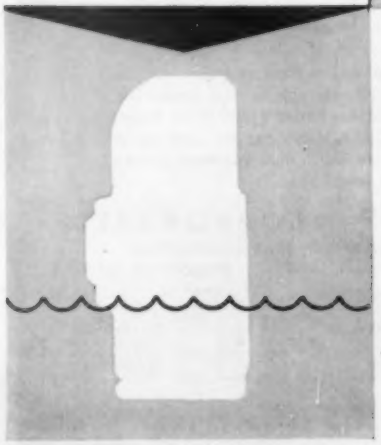
Timken carbide insert bits of 4½-in. size were tried experimentally, but proved somewhat large for the drills and required a considerably higher compressor capacity for a given production rate in this rock.

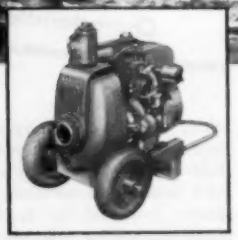
For the 3-in. Air Tracs, special 1¼-in. hexagonal alloy drill steel was used in 10 ft. length with threaded bits; holes were drilled full depth without changing bits, by adding steel length, with considerable production advantage. The 3-in. drills with tungsten carbide bits averaged about 350 ft. per 10-hour day per drill.

● *Blasting.* The contractors estimate that the 1,500,000 cu. yd. of rock ex-

● Clearing was done with chain saws. McCollouch saw in action here.

BARNES PRIMES WITHOUT FAIL WITH ONLY 1/3 WATER LEVEL IN PUMP





The patented self-priming principle in Barnes *"33,000 for 1" Pumps picks up the prime with only 1/3 normal water level in the pump—and primes extra fast. Reduces down time due to priming failure. Cuts hauling of priming water to a minimum.

BUY BARNES SELF-PRIMING CENTRIFUGAL PUMPS

See your BARNES distributor today or write for Catalog R3.

BARNES MANUFACTURING CO.

Mansfield, Ohio Oakland 21, Calif.

Buy the Best... Buy Barnes

... for more details circle 183, page 16

● This culvert (Toncan twin 124-in. corrugated plate pipe), washed out in the August hurricane, was re-assembled (see uncoated replacement sections), and was again wrecked by the October storm.

● What the hurricane and cloudburst did to the state secondary access highway leading to the Groves job.

What the Big Storms Did to the Groves Project

cavation will require 2,000,000 lb. of explosives; over one million pounds had been used up to November 1. Explosives were being supplied in the 40% and 60% gelatin and gelatin extra categories from Atlas, Du Pont, Hercules and American Cyanamid.

Following are notes on two typical wagon drill holes shots, representative of the company's constantly varying methods:

(Case 1.) Shot of 300 holes for the first lift of a 70 ft. cut depth was designed to protect a farm house located less than 300 ft. from the center of the blast area. The irregular surfaced area was drilled to 24 ft. average depth on 5 to 6 ft. centers, using 2⅞ in. Timken bits. Holes were charged with 40% gelatin at the rate of 100 lb. per ft. of hole. Atlas caps were placed one stick from the bottom; 5 to 6 ft. of stemming used.

The holes were wired 35 to a series using No. 20 wire, and the lead wires tied into a bus wire arrangement.

Using delay caps, a delay pattern was adopted consisting of a series of concentric horseshoe shaped rings, delays working outward from zero in the center to 6-delay at the outer edge. The blast, detonated with a Du Pont machine, left a well centered heap of material of good fragmentation. The adjoining house was unharmed in any way.

(Case 2.) This shot varied only slightly from case 1. The shot was in a level floor in a deep cut. 250 holes of 16 ft. depth spaced over an area approximately 400x500 ft., was drilled to yield about 12 cu. yd. per hole. American Cyanamid 40% extra gelatin was loaded, using Atlas Rockmaster caps, with a horse-shoe or U-shaped pattern of delays. Up to 50 holes were wired into each series. The bus wire in this case was strung along the edge of the work, using notches in the corners of paper cartons for supporting the wire off the ground.

Blasting foreman Pat Wiggins on this entire job has followed the practice of stringing a bus wire for each blast area, mounted from one to three feet off the ground on sticks or car-

● Outdoor on-the-job grinding station, where Timken tungsten carbide insert rock bits were sharpened to keep twelve Air-Trac's working.

ried over the tops of dynamite cartons. Tying each series into this single wire, under a "reverse parallel hook-up" helps to equalize current distribution and greatly facilitates wiring and testing large shots for better and surer results.

Foreman Wiggins has kept a detailed pocket-notebook record of each blast, covering the date, time of day (to the minute), number of holes, hole depth, pounds of charge, pounds of charge per delay, and station location.

● *Filling and Rolling.* The rock encountered made excellent fill, the specifications requiring that rock be placed in layers not exceeding 2 ft. and spread with bulldozers, with no requirement as to rolling. Rock cannot be used in the upper 2 ft. of the fill.

Soil materials consist of glacial till, sands, gravels and some finer soil but relatively little clay. A standard density, depending on the weight of the material is required under a "results" and methods type specification for rolling. A 50-ton Bros rubber-tired compactor and several sheepsfoot roller units have been employed variously, and a Hyster grid roller was used on finer soils. In general, rubber-tired rollers are used for granular materials and sheepsfoot or grid rollers for the finer till soil.

● *Culvert washout.* In more ways than one, a twin-pipe culvert on contract 030 is of special interest. The culvert, designed to carry a mountainside creek under a deep rock fill, consists of two lines of 126-in. by 550-ft. corrugated multi-plate pipe, asphalt coated, furnished by Republic Steel. The design of this structure called for bedding the pipe in granular material, compacting material carefully around it, and carrying the rock

● Rolling of earth fill was done with various equipment. Hyster grid roller used here along with two sheepsfoot units (not in picture) to keep up with high-speed delivery by Caterpillar DW21's.

fill on up to its maximum height of about 96 ft. over the pipe.

About 300 ft. of each line had been assembled and bedded when the August hurricane and rains struck. One pipe was rolled over on its side. The other was picked up and washed bodily to an adjoining parallel stream and a distance of *one third of a mile downstream.* Two weeks were required to unbolt the remains, truck the reusable sections back to the site, get delivery on replacement sheets, and reassemble the pipe in position while also rebuilding the washed-out culvert bed.

In October when the second storm hit, the pipes had been bolted to about 475 ft. length and about 25 ft. depth of rock fill placed over the downstream end, covering about 300 ft. of each pipe. What this storm did to the pipe is shown in the accompanying photograph. The pipes became blocked with boulders and gravel and the pressure of the dammed up water under and around the pipes floated them until they arched, permitting the bed to build up and hold them thus. The contractor blasted a hole in one pipe to relieve the pressure. This second episode cost Groves another month's delay in rebuilding the culvert, meanwhile requiring a shift in shovel work and "Fritzing up" the whole operation until rock filling could resume.

● *Advance Engineering.* Unusually thorough advance engineering procedures were followed in determining the turnpike location through the Berkshires and securing subsurface data. Under the general consultants the contracting engineers, Thomas Wooster Corporation, of Boston, conducted ground and aerial reconnaissance over a 10-mile band to determine the best general line. Aerial reconnaissance of this section was performed by Fairchild.

After the line was chosen, borings were made at 500 ft. intervals and at structure sites and seismographic readings taken from which data on the soils and rocks were obtained for design purposes. Gahagan Construction Co. performed the Siesmic surveys and Sprague and Henwood were the boring contractors. This information, while not extensive enough to tell the contractor all the unknowns, was an aid in developing the bids. Project manager Day also made his own ground reconnaissance.

● *Acknowledgements.* The S. J. Groves & Sons Company staff on the Massachusetts Turnpike includes Sam Day, project manager; Don Blake, superintendent; P. L. Sprenger, project engineer; "Bud" Miller, office manager; Don Nelson, shop foreman; and P. H. Wiggins, rock foreman.

William McQueen is resident engineer for Thomas Wooster Corporation, section engineers serving on location, plans and supervision. Howard, Needles, Tammen & Bergendoff, are general consultants for the Authority.

● Opening up a spongy hillside behind the clearing crew — a 4½-yd. shovel with dozer clearing haul paths.

Major Equipment on Massachusetts Turnpike Project

S. J. Groves & Sons Company, Sections 030 and 031

Shovels
- 2 Bucyrus-Erie 88-B (4½-yd.)
- 2 Bucyrus-Erie 54-B (2½-yd.)
- 3 Northwest 80D (2½-yd.)
- 1 Bucyrus-Erie 47-B (1¾-yd.) dragline
- 2 Bucyrus-Erie 22-B (1-yd.) crane-backhoe
- 1 Lima Paymaster (¾-yd.) crane
- 1 Lorain motor crane

Compressors
- 13 Ingersoll-Rand Gyro-Flo 600
- 1 Ingersoll-Rand 315
- 3 LeRoi 105 (Tractaire)

Wagon Drills
- 19 Gardner-Denver
- 12 Gardner-Denver, with Air Trac mounting

Tractors
- 21 Caterpillar D8
- 1 Allis-Chalmers HD 21
- 1 Allis-Chalmers HD 20
- 2 Caterpillar D6
- 1 Caterpillar D4

Scrapers
- 7 LeTourneau
- 5 Caterpillar DW21

Compactors
- 1 Bros 50-ton rubber-tired
- 2 Gebhard dual sheepsfoot
- 1 Grace 12-ton rubber-tired
- 1 Hyster grid roller

Wagons
- 26 Euclid end-dumps (incl. 12 22-ton, Model 36TD)
- 4 Euclid bottom-dumps (15-yd.)

Motor Graders
- 3 Caterpillar 12

Trucks
- 7 Dodge Power Wagons
- 2 Ford F-500, all-wheel-drive, Marmon-Herrington drive
- 2 Ford F-600, all-wheel-drive, Marmon-Herrington drive
- Several other trucks (being replaced by all-wheel-drive units)
- 9 Willys Jeeps (all-wheel-drive)
- 7 Willys pickups (all-wheel-drive)
- 4 Ford pickups
- 2 Willys station wagons

Light Plants
- 2 General Electric 16 kw (war surplus)
- 1 Caterpillar 30 kw
- 8 Kohler 5 kw
- 6 Kohler 1½ kw

Radiotelephone

General Electric low band frequency, with office and shop stations and 8 mobile units, increased to 14 units as work progressed.

The Massachusetts Turnpike Authority, for which this project is being built, is headed by William F. Callahan, chairman; Benjamin A. Grout, vice-chairman; and John R. Kewer, member, with Philip H. Kitfield, chief engineer; John McClosky, assistant chief engineer; and Edward Delaney, specifications.

Public Works Not "Shot in The Arm" to Eliminate Depressions

THE notion that local public works expenditures might be juggled within a business cycle, to bolster the economy and relieve unemployment during depressions, may not produce the results expected.

So said Dr. Harold C. Taylor, director, W. E. Upjohn Institute for Community Research, Kalamazoo, Mich., speaking before the APWA Congress at Milwaukee. In a paper entitled "Public Works Policies for Boom and Bust" Dr. Taylor, reported that an investigation conducted by the institute revealed such a policy may not produce the results generally attributed to it.

This institute, a privately sponsored nonprofit organization, was established ten years ago to do research on the causes and effects of unemployment, and on ways to avoid or cope with unemployment. Although there are many kinds of unemployment, the institute has been especially preoccupied with the unemployment aspect of the phenomenon of boom and bust. They have been especially concerned with what can be done by individuals and by communities; by what individual firms could do to provide steadier jobs and what local governments can do to keep the economy of their communities on an even keel. In the latter case they came to be preoccupied with public works programs. He points out that since the middle thirties, there has developed a fairly wide-spread notion that public works expenditures might be juggled within a business cycle in such a way as to provide a balance wheel, by reducing excessive expenditures during boom times and increasing expenditures in this field during the time of depression to relieve unemployment.

Dr. Taylor and Eugene C. McKean with the help of Professor William Haber of the University of Michigan wrote a book entitled "Public Works and Employment from the Local Government Point of View," which has just been published by Public Administration Service.

In his paper, Dr. Taylor stressed that the basis for public works timing depends on the needs of the community, that by and large public works are not frills which a community may choose to get along without, more or less by whim. Public works are essential parts of the productive plant of the community. He points out that when the number of homes, factories and stores go up 20 percent, water pumpage requirements will go up, sewage treatment requirements increase and more schoolrooms will be needed. As automobile traffic increases additional traffic lanes are required. Said Dr. Taylor, "The economic utility of these automobiles will be diminished — at real out-of-pocket costs — unless you can provide enough additional traffic lanes to handle the traffic."

The paper stresses that schools and highways account for around half of all state and local public construction. Added to these requirements the construction related to police, fire, sanitation and utilities accounts for around three-fourths of all public works construction. Dr. Taylor concludes from these figures that there is little leeway for shifting public works construction very far away from the time when the facilities are needed.

Employment in Depression

To indicate the effectiveness of deferring some public works until a community faces an unemployment problem, Dr. Taylor uses an example of a typical community of around 130,000 population with a labor force of 50,000. In a recession with 10 percent unemployment, 5,000 people would be unemployed. Although the figure varies from time to time and from place to place, employment on local public works in good times runs about 0.5% of total employment, or in this case 250. Dr. Taylor believes that a 10 percent unemployment would result in a 50 percent drop in public works employment or to around 125 people on local works projects. This results in an average public works employment, through boom and depression, of around 188 people. The average is higher, by 63 people, than the depression low of 125. He cites that if a steady pace of public works construction through boom and depression in this illustrative community had been maintained, that it would be possible to provide jobs during a depression for only an additional 63 people. Assuming that construction financed with state funds in this community had also been stabilized it might be possible to add another 40 jobs, a total of around 100 jobs spread among 5,000 unemployed people or a total of 2 percent, "hardly a drop in the bucket."

Speaking of the plausibility of stabilizing the construction industry to mitigate the violent upheavals of boom and depression, Dr. Taylor points out that the dollar levels of private construction, which reached a peak in 1926, fell by 1933 to only 1/8 of the peak level. He also recalls that state and local public works (which were 90 percent of all public works during the twenties and thirties) fell in current dollar from a peak in 1930 to ⅓ of the peak level in 1933.

Applies 1920-1939

Dr. Taylor and McKean, using an empirical approach reached some interesting conclusions on the application of this theory to the boom-bust period 1920-1939. Using a stable pace of spending over these years compared to money actually spent they found that a stable-spending policy would have shaved off a few hundred million in some of the boom years of the twenties and would have added a few hundred million in some of the depression years of the thirties. To determine the effect of this difference on the economy during this period, they used the gross national product produced in a given year which ranged from a high of $104 billion in 1929 to a low of about $56 billion in 1933. Dr. Taylor points out that adding or subtracting a few hundred million one way or the other by stabilizing public works expenditures would have resulted in an average of all changes plus and minus, of six-tenths of 1 percent. Based on these conclusions they felt that the effect of pump-priming would be but a fraction of 1 percent and is hardly worth exploring.

Referring to the theory that by spreading out construction, less ma-

terials would be bought at high boom prices and more at low depression prices resulting in savings, they computed the costs of public works purchases at a perfectly uniform pace in volume terms year by year. Surprisingly enough they found that under stabilization the public works would have cost just a little more than they actually did. They readily admit that questions could arise about this finding, but feel that no dramatic savings could be expected.

Concerning these findings, Dr. Taylor said:

"If our findings meet with general acceptance, they will require some reappraisal of the tools in our arsenal of weapons to cope with instability and depression. An unrealistic reliance on this tool of public works could blind us to the necessity of searching for other and more effective tools."

Concluding his paper, Dr. Taylor reiterated the basis for public works should need: The time to build a bridge is not when prices are low, or when the economy needs a shot in the arm, but when the bridge is needed.

Meetings Ahead

AMERICAN ROAD BUILDERS ASSOCIATION 54th annual convention and Highway Materials and Supplies exhibit, Municipal Auditorium, Miami Beach; January 11-14, 1956.

HIGHWAY RESEARCH BOARD — 35th Annual meeting, Washington, D. C.; January 16-20, 1956.

ASSOCIATED EQUIPMENT DISTRIBUTORS — 37th annual meeting, Conrad Hilton Hotel, Chicago, Ill.; January 29-February 2.

SOCIETY OF AMERICAN MILITARY ENGINEERS — Annual technical meeting, Palmer House, Chicago, Illinois; February 9-10, 1956.

THE ASSOCIATION OF ASPHALT PAVING TECHNOLOGISTS — annual meeting, Hotel Cleveland, Ohio; February 13-15, 1956.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA — Annual Convention, Waldorf-Astoria Hotel, New York, N. Y.; February 13-16, 1956.

ASSOCIATION OF HIGHWAY OFFICIALS OF NORTH ATLANTIC STATES — 31st annual meeting, Hotel Statler, Boston, Mass., Feb. 29. - March 1.

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One man can remove a Crawler Track Master Pin or a Sprocket or both in mere minutes with the OTC Hydraulic Puller and Attachments. Available in 50 ton or 100 ton capacities these versatile sets are easily and quickly put to work in the shop or field. Hand or electric pumps are available . . . The OTC POWER-TWIN HYDRAULIC UNITS are also easily adapted to pull, bend, straighten, press or spread—pull or install bearings, sheaves, gears or pulleys on all types of contractor equipment. Quickly pay for themselves in man hours saved. For the complete story on the OTC Hydraulic line write for Bulletin HY-55.

Removing International Harvester Sprocket with OTC Hydraulic Ram and Adaptors.

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Contractors, don't let cold weather delay construction, slow down production, increase costs. The Clayton Summeraire portable, oil-fired space heater dries out new construction; prevents freezing of concrete while curing; thaws out ground, materials and equipment; keeps workmen warm. Summeraire . . . priced 20-30% lower than other heaters of less capacity . . . delivers 2400 cu. ft. high velocity heated air per minute at low cost; 300,000 BTU's per hr. Available with electric or gasoline engine drive. Send coupon for details.

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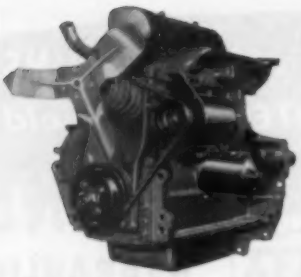
. . . for more details circle 190, page 16



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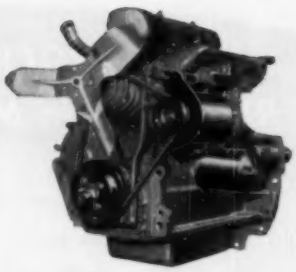

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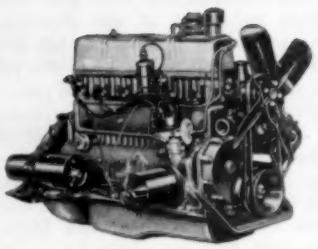

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134	4	3.44 x 3.60	134	6.6 to 1	48 @ 2800	110 lbs.-ft. @ 1400 rpm
172	4	3.90 x 3.60	172	6.75 to 1	61 @ 2800	148 lbs.-ft. @ 1400 rpm
223	6	3.62 x 3.60	223	7.8 to 1	107 @ 2800	202 lbs.-ft. @ 2000 rpm
272	8	3.62 x 3.30	272	7.6 to 1	131 @ 2800	249 lbs.-ft. @ 2400 rpm
332	8	3.80 x 3.66	332	7.5 to 1	160 @ 2800	308 lbs.-ft. @ 2300 rpm

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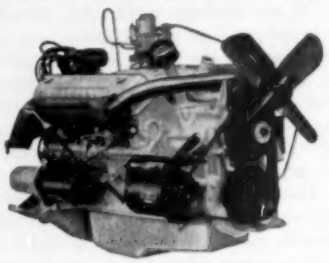
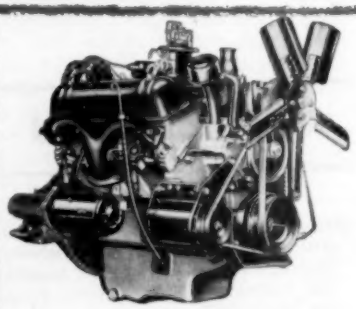


FORD "272"



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FORD Foot Mounted Power Unit

FORD Skid Mounted Power Unit

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Ohio Pioneers in Better Use of Aerial Engineering

How the Ohio Department of Highways is making more effective use of its technical manpower, cutting costs and saving months of time in the use of photogrammetry and related procedures. This review covers reconnaissance, selection of locations, staking, cross-sectioning and other steps as applied to highway and bridge projects.

By Duane L. Cronk

Washington Editor of ROADS AND STREETS

ONE clear day last January a small twin-engine plane cruised leisurely over the hilly woodland in eastern Ohio. Inside, a pilot and an aerial photographer with the Ohio State Highway Department combined their skills to photograph the rough terrain below. Their percision camera, clicking every five seconds, registered every hill and stream, road and bridge, farm house and fence in a 7,000-ft.-wide swath.

The record rolled up by the inquisitive lens was more accurate and complete than a meticulous surveying party could have turned in after weeks of strenuous groundwork.

Two days later, after processing, the photographic "field notes" revealed a wealth of information about topography, the existing traffic network, land use, soil conditions, drainage areas, gravel deposits, and rock formations. All these facts were necessary in order to locate, design and build a highway through the area on the most direct and economic route.

Using the triple tools of plane, camera, and photogrammetric plotter, the Ohio engineers have developed an engineering method that makes it possible to determine location with accuracy and at dramatic savings in time, money and manpower.

Aerial photography and photogrammetry (the interpretation and measurement of images in aerial photographs) have been used, experimentally, at least, by a number of state highway departments, usually for reconnaisance and preliminary surveys to determine location and to prepare construction plans. But in no other state, apparently, has the highway department adopted the method as complete staff operation.

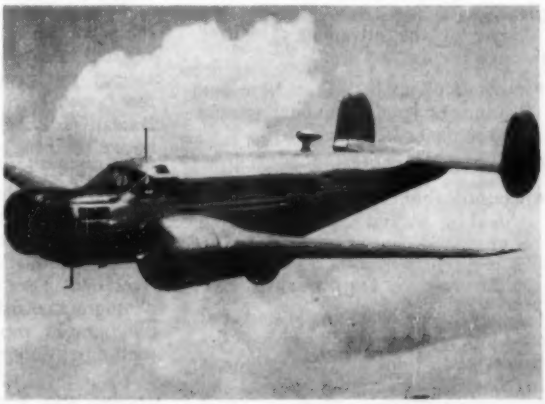


Fig. 1. Ohio's highway mapping plane in flight.

Fig. 2. Plane nose and location of mapping camera; pilot and photographer in position.

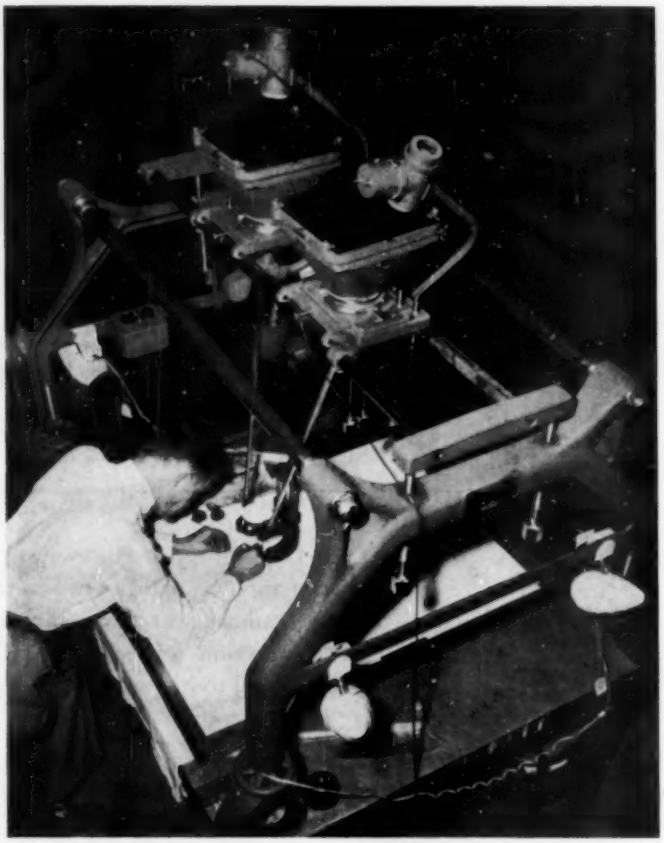


Fig. 3. Kelsh plotter operator working on bridge site plan. Original photography is 1" = 200'. Finished site plan is 1" = 20' with 2-ft. contours.

In Ohio, the highway department has operated its own plane and taken its own photographs since 1946 — work on which almost all other states seek outside assistance. From its own photographs, the Ohio aerial engineers not only make preliminary highway survey reports, but complete final designs and prepare construction plans.

Some of the advantages realized through the method are:

- Savings of up to 90% in time and manpower over traditional ground survey methods.
- Significant savings in costs.
- Considerably more vital detail than would be practicable to expect from a ground survey.

Savings In Engineering

Today, the advantages in cost and accuracy are overshadowed by the conservation of engineering manpower that aerial photography permits. In this respect, William T. Pryor, chief of Photogrammetry and Aerial Surveys for the Bureau of Public Roads said recently:

"Here is a method that can largely release engineers from the arduous task of making reconnaisance and preliminary surveys thus enabling understaffed design departments to handle their design work more efficiently and to get it out faster."

Manpower savings are greatest in rough country, Ohio has discovered, where ground crews could spend days and come out with less information than an aerial photographer could register in seconds and a photogrammetrist interpret and measure in a few hours. E. S. Preston, chief of the Bureau of Location and Design, believes that in such situations aerial photography reduces manpower expended on surveying by as much as 90%. (As an extreme example, perhaps, a ground crew would be lucky to survey 300 ft. a day up a typical river cliff, Preston points out, but a photogrammetrist, working from aerial photographs, could do a mile a day of such rough topography.)

The typical procedure for location, design, and plan preparation from aerial photographs in Ohio includes the following steps:

- Reconnaisance of the area is made from existing small-scale aerial photographs and contour maps to determine alternate routes. After comparison, the best route is chosen for preliminary survey.
- Establishing ground controls along the proposed route to show up in aerial photographs.
- Flying and photographing the proposed route.
- Drawing a topographic map to a scale of 200 '/", with contours at 5 ft. intervals, from the aerial photographs.
- Locating best of several alternate location lines on this map, along with other pertinent data.
- Transferring the design location from the map to the ground, by striking the center line.
- Flying and photographing the line at 1,650 ft.
- Drawing a Planimetric map to a scale of 50'/" and obtaining data for cross sections from the photographs.
- Final design and preparation of construction plans.

Ohio makes its reconnaissance of the area through which a new high-

way will run from already available aerial photographs (at a scale of about 1/80,000) and new 2,000′/″ quadrangle sheets drawn by the U. S. Geological Survey.* These maps when blown up to 800′/″ are surprisingly accurate and ideal for selecting several alternate routes.

The preliminary report is based on a study of these materials, along with other data on traffic, land use and existing roads. The best of the several alternate routes is selected, broken down into projects and programmed.

To establish location and make preliminary designs it is necessary to obtain contour maps at a scale of at least 200′/″. A high-level flight is made over the route and from the aerial photographs obtained the preliminary survey is made.

Before this flight, however, a small survey crew from the division office will run a traverse through the area from existing government controls. In rough country the traverse is usually a shortbase triangulation net with stations at approximately 2,000-ft. intervals, summit to summit.

Using a Kern 1-second Theodilite, self-centering tripod, subtense bars and radio communications, horizontal and vertical controls are established simultaneously. So they can be identified in the flight photos, all new stations and existing control points are marked with a 4 ft. square piece of cheap muslin. Vertical angles are read to wing points and the corresponding horizontal distances are later scaled from the manuscript for elevation determination.

The first flight, made at 6,600 ft. produces photos on a scale of 800′/″. In the plotter, however, these are seen at 200′/″. After processing and indexing, stereo plates for use in the plotter are made. A strip mosaic at 800′/″ is also pasted up from the series of 9″x9″ individual prints. These become the working tools for the preliminary design engineer. As control for the 200′/″ map becomes available, it is plotted by coordinates on larger rolls of Dyrite or Loftrite, or on paper-cloth or linen. Whenever it is economically feasible, the state system of coordinates is used.

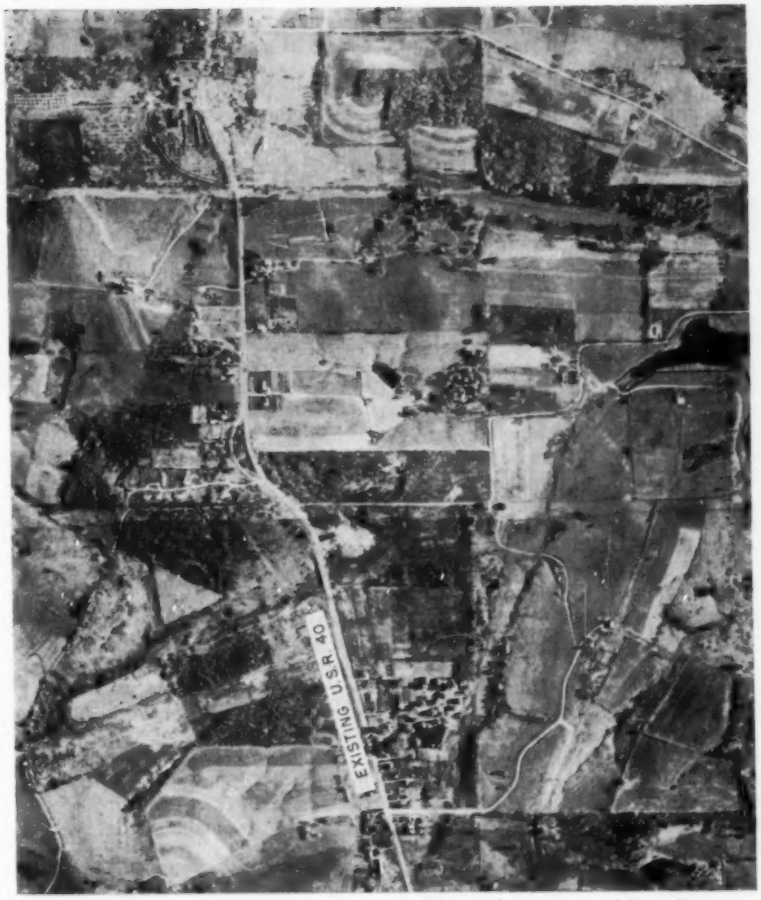


Fig. 4. Example of mosaic first flown at 1″ = 800′ for studying proposed lines. Then two gloss diapositives of adjacent negatives in flight-line (not shown) are made and placed in plotter. (Figures 4 to 9 inclusive show site of U.S. 40 St. Clairville by-pass, as actually developed and built by aerial methods.)

*Only 33% of the United States is adequately mapped for engineering reconnaissance survey purposes, but within the year the entire country will have been photographed at a scale suitable for making route determinations.

Preliminary Design Stage

Once the design standards have been established, the preliminary engineer lays out several probable alignments on the map. Each line is stationed and a profile made by plotting elevations of the contours as they are crossed by the line. The profile is plotted at 20′/″ vertically and 200′/″ horizontally. A grade line is laid on the profile and the proposed typical section is put on the cross sections.

After adjusting the lines vertically and horizontally to get the best alignment, location engineers examine each with regard for drainage, intersections, total cost and highway user benefits. The best alternate lines are replotted on a second print of the map, and a determination made of drainage and structure location and size.

- Because of the intensifying shortage of highway engineers, the problem of utilizing engineering manpower has moved into the top rank of highway management problems. Last year, a task force was organized by the American Road Builders Association to explore the engineering needs for a greatly expanded highway construction program. One of the strongest recommendations the industry leaders made was that photogrammetry be used wherever possible as one way of saving engineers for other work.

- The Ohio Highway Department with $185 million in construction awards in 1955, relies heavily upon aerial photography to lighten its design load. Officials there believe that most preliminary survey work can be done best from about 6,600 ft., and that much final design and construction plan work can be prepared from aerial photographs.

To make the cost comparisons, contours based on the recommended grade are super-imposed on the map. The amounts of cut and fill are determined by planimetering end areas of horizontal section defined by the grade contour and the original ground contour and multiplying by the contour intervals. This method yields a graphic picture of the finished work from which lengths of structures, right-of-way and grade can be determined.

Aerial photography is useful in furnishing other materials on which a line decision can be made — the proposed line can be drawn on a mosaic of the area, a model can be projected on a screen and studied stereoscoptically by a group of officials, aerial oblique photographs can be taken, enlargements made of built-up areas, and an artist's concept of the finished highway drawn realistically onto an aerial photograph.

When a proposed line selection has been made and preliminary design completed, the final survey phase is started.

Staked Before 2nd Flight

The Ohio engineers stake the design location on the ground and run the center line, either by scaling coordinate locations from the map and tying to the previously signalized base line, or by scaling reference measurements from the manuscript that will serve as control for the directions of the various tangents. A survey party from the photogrammetry section uses this method to stake points on the tangents. By setting up on points overseeing much of the entire tangent area, and by using radio communication and 30-minute flares, they can set additional stakes on line. This prevents changes in the alignment through poor instrument work, and the best fit of the preliminary designated location to the ground is assured. Projection of the tangents to intersection, measurement of deflection angles and staking of the line are undertaken by division field crews. The center line is signalized every 400 ft., bench marks are set and profile levels run.

"If we have enough horizontal controls, vertical controls and known elevations down the center line, our accuracy is bound to jump up," Preston pointed out. "By establishing all of these points before making our second flight, they will appear in the photographs and yield the greatest benefit from the ground work. This is all work that would have to be done anyway, at a later stage."

The same crew picks up property lines involved and obtains the names of owners. (The completed photographs are invaluable to right-of-way agents in later negotiating with owners.) They also record underground drainage and utilities not observable from the air.

The second flight, made at 1,650 ft., produces photographs of the road location on a scale of 200′/″, seen in the plotter at 50′/″. Prints for control identification and diapositives covering the entire project are made. The center line is replotted on rolls at 50′/″ for planimetric mapping. Profile elevations, at every 100′ stations are plotted on this roll to assure accuracy. Two-foot contour interval site plans for structures and major intersections are plotted first, then the planimetry and cross sections are plotted. Cross sections are read to 0.1 ft. and plotted at true right angles to tangents. They are extended well beyond the proposed right-of-way.

Any elevations other than controls that would be taken in the field are read with the plotter. Drains are contoured where necessary. Interchanges and developed areas are contoured at 2 ft. intervals. Alignment sheets are traced from the planimetric map. After plotting, the site plans are precisely ratioed to 20′/″ before tracing.

Final design and construction plans, upon which it is possible to obtain reliable estimates, can then be produced in traditional manner.

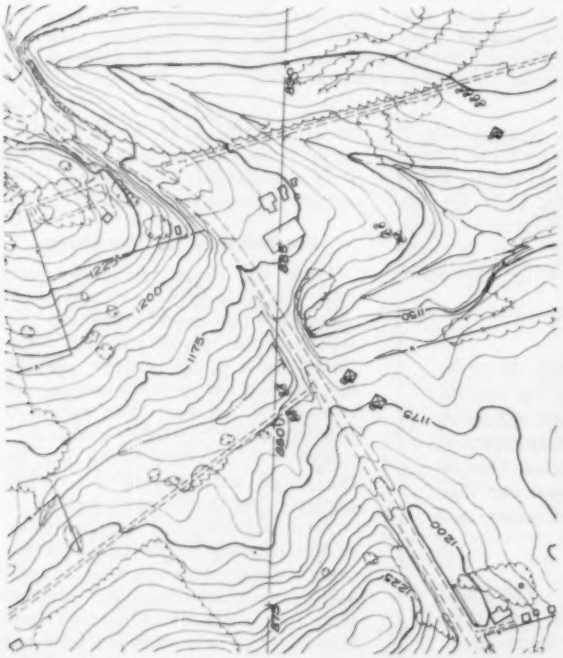


Fig. 5. From diapositives, a topographic map is produced at scale 1″ = 200′ with 5-ft. contour intervals. After study of map a final line is selected, traverse and control run in field, and line marked on ground with lime or cloth.

Fig. 6. Line is then reflown at scale 1″ = 200′ from diapositives, where bridge or interchange site is involved, a topographic map is prepared at scale 1″ = 50′ with 2-ft. contours. (See Fig. 7).

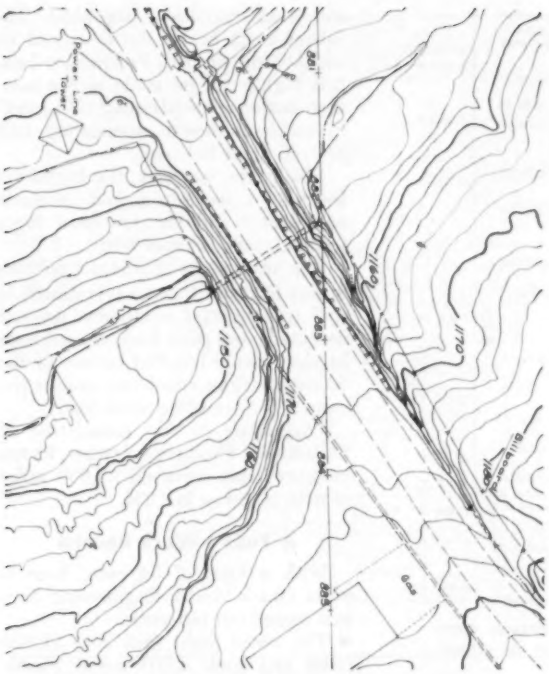


Fig. 7 Portion of topographic map 1" = 50' with 2-ft. contours for bridge site.

Fig. 8. For other points along proposed line a planimetric map at 1" = 50' is prepared, with centerline and stationing.

How It Started

What does it take to get into aerial engineering? Ohio started out in 1946 with an engineer-pilot, an aerial photographer who had been trained in the armed services, a war-surplus plane and aerial camera.

Today, the Aerial Engineering Section's inventory lists nearly $105,000 worth of equipment, broken down among the units as follows:

Flight operations	$29,375
Photo laboratory	27,265
Photogrammetry	34,643
Plan Preparation	13,675

Ohio uses a war-surplus Beechcraft, modified to seat five passengers, in addition to the pilot and co-pilot. It is frequently used to transport department officials on business trips.

The aerial engineers use a Fairchild Cartographic camera with an 8¼-in. focal length and 9"x9" format. Four Kelsh plotters, also with 8¼-in. focal length, in use by the department now, are considered ideal for large-scale mapping.

Ground crews whose job it is to establish control points are equipped as described earlier.

Bridge Sites by Aerial Survey

● Almost all bridge location and site work in Ohio is done from aerial photography.

The division engineers send the Aerial Engineering Section a sketch map showing approximate location and bench marks. The area is then flown to obtain photos from which 50'/" topo maps with 2 ft. contours are plotted directly off the photos by stereo plotter.

● These maps are then put through the copy camera and enlarged to 20'/" scale, transferred onto tracing cloth and sent to the division. There the proposed line and grade is added and then returned to the Bridge Bureau for design.

● Time in the field: one-half day for two men, establishing ground controls at four to six elevations off known bench marks near the site.

● The cost: about $80 to the Aerial Engineering Section for ground work, flight, lab. work, materials and photogrammetry, plus from $70 to $112 in costs to the division. Employing traditional methods, the survey and mapping cost would be at least $1,000, officials believe.

Building a Staff

Obtaining men experienced in aerial engineering is not as easy as obtaining equipment. The Ohio Highway Department, over the last 10 years, has developed a hard core of experienced men, but it was difficult getting started.

"The whole secret of adapting aerial photography to highway engineering is to start with highway men," Preston declared. "It is a lot easier to make an engineer into an aerial engineer than to make an aerial photographer or photogrammetrist into an engineer."

Ohio leaders believe that after a decade of developing a staff and building up equipment, there are advantages to the staff operation. R. H. Sheik, chief of the Aerial Engineering Section, claims it is cheaper and faster to "do-it-yourself," that the department has better control over scheduling of the work and accuracy in the final product.

"If you are going to do aerial engineering yourself," thinks Sheik, "you have to learn how to make the most of time. We have to take advantage of every clear day during our flying season and obtain enough photography from December to March to keep the rest of our staff busy the year around."

There may be only 40-50 hours of flying time a month in the flying sea-

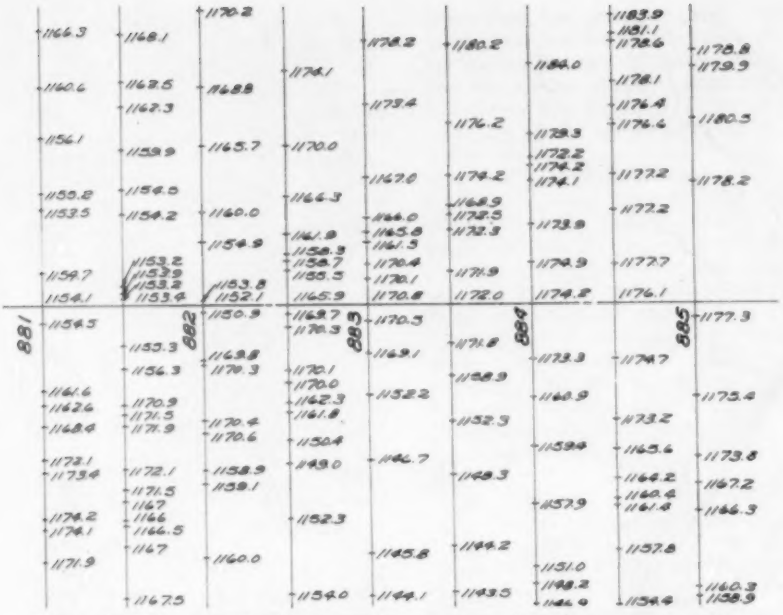


Fig. 9. At 50-ft. intervals along centerline, or as required due to terrain, cross sections showing ground elevation are taken on a line perpendicular to the centerline and extending at least 200 ft. each side of the centerline.

From the above information, maps, and other engineering data, complete construction plans are prepared by the plan preparation unit.

Aerial Photography for Widening Projects

- Ohio uses aerial photography for developing contract plans on widening and resurfacing jobs, as well as for new work and relocation.
- The existing highway is flown at low altitude, after a ground crew has signalized control points every 400 ft. down the center line and noted the structures that will need widening. Planimetric maps on a scale of 50'/" are traced onto line sheets from the aerial photographs, along with drainage features and structures.
- Grading contractors bid on the work by 100-ft. stations rather than by cubic yards. Application of method is limited to level stretches.

son when conditions are ideal. The foliage must be off the trees and no snow on the ground. Preliminary location flights can be made in the summer, but advance planning is "a must" to make an aerial engineering unit pay off, Sheik believes.

Ideally, he suggests, the high-level flight for a location should be made one winter and the low-level flight for final design a year later.

The advantages of contract services in this field are that an investment in staff training and equipment are not necessary, and peak loads can perhaps be more easily handled by one of the 30 outside firms which can assume the costs of a fluctuating work load.

(According to the Association of Professional Photogrammetrists, its ten member firms surveyed 25,000 miles of new highway in 1954.)

A Year's Work Record

With a total of 54 men, here is what Ohio's Aerial Engineering Section turned out last year:

- The aerial flight unit flew 57,000 miles and took 3,705 aerial photographs.
- The laboratory department made 12,422 contact prints, 2,307 enlargements, 1,235 negatives, plus a number of plates, lantern slides and ozalid prints.
- The photogrammetric unit prepared 176 bridge site plans, 12 topographical maps, 12 miles of cross-section by use of stereo plotting machines, and 27 mosaic aerial photo maps covering an area of 780 square miles.
- The engineering report unit, newly organized during the year, completed four preliminary engineering reports for 46 miles of highway from aerial

Fig. 10. Individual photograph of a bridge on S.R. 161 in Franklin county at scale 1" = 200'. Diapositives of two adjacent overlapping photographs are placed in the Kelsh and plotted to scale 1" = 50' with 2-ft. contours. This map is then copied and enlarged to 1" = 20'. From this copy; tracing is made and sent to the division office to have proposed line and grade placed on tracing and then returned to the Bridge Bureau for design of structure.

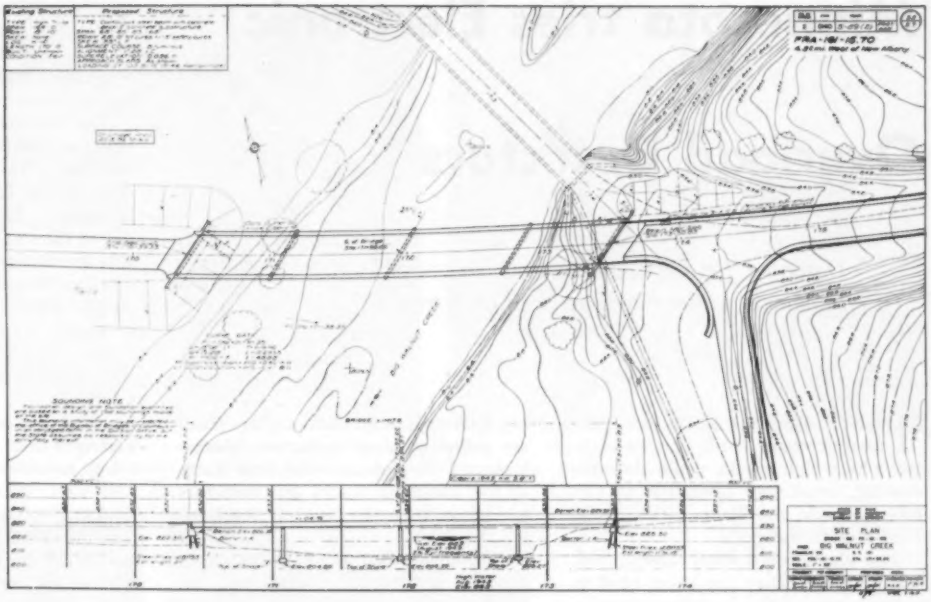


Fig. 11. Finished site plan for bridge (see Fig. 10).

Aerial Operating Budget for Year

The 1955 operating budget of $285,828 for the Aerial Engineering Section was as follows:

	Employees	*Labor*	*Operating Expense*	*Totals*
Administration	3	$ 15,156	$ 500	$ 15,656
Aircraft Operation Unit	3	19,920	14,200	34,120
Photo Lab. Unit	5	21,504	9,000	30,504
Photogrammetry Unit (field — 8) (office — 10)	18	72,072	10,000	82,072
Plan Preparation Unit (report — 5) (design — 20)	25	118,476	5,000	123,476
Totals	54	$247,128	$38,700	$285,828

Fig. 12. Aerial oblique of finished bridge after being opened to traffic (see Figures 9 and 10).

photographs and about 80 miles more under way. The unit also prepared complete construction plans from aerial photography for seven projects totaling 27.7 miles in length and estimated to cost some $7.3 million. (This year, construction plans will be prepared for nearly $21 million worth of work.)

Aerial engineering is constantly being improved by the Ohio Department. Today, although a stereo plotter can measure verticals to an accuracy of 1/10th of a foot, a simple 50′/″ rule must be relied upon for horizontal measurements.

The Ohio Aerial Engineering Section, however, has a private instrument firm under contract to develop an instrument which will give the same accuracy in horizontal distances as in verticals. The next step is a device that will give instantaneously (and register on tape) the elevation and distance from the center line of any spot on the map. Working from a few control points, photogrammetrists will then be able to further reduce the plotting time.

"In another year we will be measuring complete cross-sections in the time it now takes us to make station measurements," Mr. Preston believes.

E. E. Stubblefield, District Engineer of the U. S. Bureau of Public Roads at Oklahoma City, has been transferred to Fort Worth, where he succeeds E. H. Swick, as Division Programming and Planning Engineer.

Minnesota tries Electronic Overload Detectors

Designed for highway research and weight limit enforcement in the movement of heavy trucks.

THREE electronic scales and overload detectors, built into the highways to weigh trucks while they are moving, went into operation in October outside the Twin Cities of St. Paul and Minneapolis.

The electronic devices have a twofold purpose. They are being used in enforcement of the laws against overloading trucks; and data collected by the scale industry will be a valuable aid in planning future highway construction.

For the majority of trucks, the scales eliminate the delay — often a long one — of pulling off the highway to be weighed on a lever scale. The new electronic scales take only a fraction of a second to weigh a truck moving 40 to 60 mph.

Trucks carrying loads under the legal limit can continue without stopping. Those that are overloaded are signalled into a weighing station where the exact amount of overload is recorded.

The scales and the sensitive recording instruments that accompany them are called overload detectors. Minnesota and Virginia are the first states in the nation to install the detectors to help enforce the laws on overloading.

The scales are level platforms in the highway, having a width equal to the traffic lane and a length of 8 feet. Each platform, 3 in. thick and weighing 20,000 lb., rests on four electronic weighing cells. These cells weigh each axle of a passing vehicle and transmit a signal instantly to the roadside overload detector, where the weight is recorded.

When a truck is overloaded, the detector lights up an electric sign reading "Go To Scale," with an arrow pointing toward the scale house. Flashing lights in the scale houses tell highway patrolmen when an overloaded truck has crossed the detector platform and is approaching the scale house.

The two new scale houses used in conjunction with the overload detectors are equipped with static scales. These, too, are level platforms resting on four electronic cells. The extremely accurate weight figures are recorded on machines inside the scale houses.

The electronic equipment, adaptations of devices used for weighing airplanes, was supplied by the Cox and Stevens Electronic Scale Division of Revere Corporation of America. These devices can be set to compensate for changes in climate and weather conditions. Such variables allowed weight deviations in the old-type lever scales.

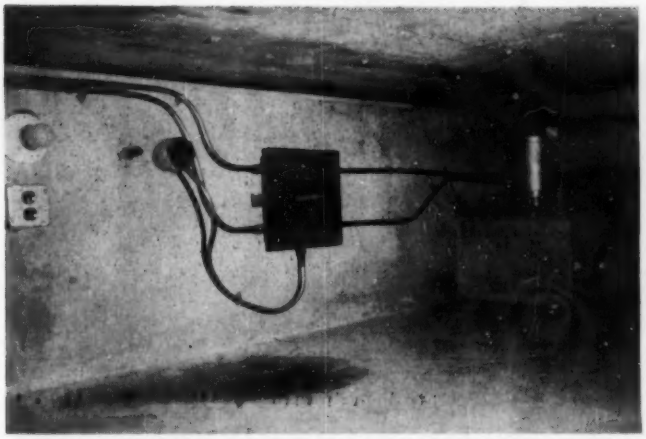
The dectector installed near St. Paul is in the westbound lane of U.S. Highway 12, just east of the city limits. An average 2,000 trucks cross that spot each day, most of them carrying manufactured goods from Illinois and Wisconsin into the Twin Cities. The scale house, which will be used for both eastbound and westbound trucks, is between the two sections of the divided highway 1,800 ft. west of the detector platform. This provides ample time and room for an overloaded truck to turn into the weighing station.

There are two overload detectors west of Minneapolis, one in the westbound lane of Highway 12, and one in the southbound lane of Highway 100 which circles the Twin Cities and intersects Highway 12. On an average day 2,440 trucks cross the Highway 100 detector platform and 1,350 trucks cross the Highway 12 patform. Most of them are carrying manufactured goods and petroleum products out of the Twin Cities to other markets in the state.

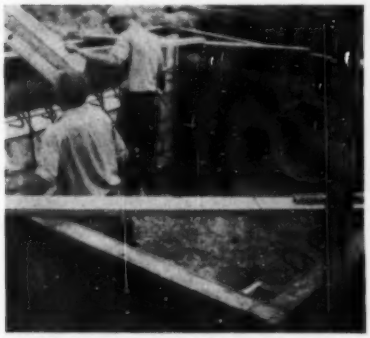
One new weighing station with an electronic static scale is being used in connection with both Minneapolis detectors. Like the St. Paul scale house,

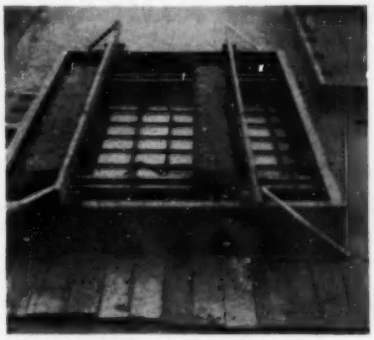
● A truck is seen approaching the overload detector platform built into the highway in the westbound lane of U.S. 12, east of St. Paul city limits.

● William G. Klett, traffic engineer, Minnesota department of highways, reads tape from traffic research recording machine.



● (Left) At right is one of four electronic weighing cells which support platform and weigh each passing axle. (Right): Scale house and static scale on U.S. Highway 12, located between the divided roadways.





● Reinforced concrete being constructed and metal platform ready to set into place for scale installation.

it is located between the lanes of Highway 12 and can be used to weigh trucks traveling in either direction.

One major advantage of the new scales, according to engineers with the state highway department, is the elimination of delay for truckers with legal loads. Also, work at the weighing stations is greatly reduced, speeding up the weighing process.

Another major advantage is that valuable traffic data can be recorded automatically on tapes to aid in research and planning. Portable traffic research machines can be located in trucks and connected with the roadside overload detectors. The machines record the amount of traffic, speed, axle weights and axle spacings.

The pits under the detector platforms, where the weighing cells and wiring are located, can be reached through a manhole in the shoulder of the highway, a little more than five feet from the inside wall of the pit. The pits themselves are 8 by 12 ft. and have a 31-inch crawl space under the platform.

The pits for the static scales are 10 by 10 ft. and have comparable crawl space underneath, reached from an entrance inside the scale houses.

Minnesota engineers contemplate the possibility of detectors at 25 or 30 locations, to enable a check on the traffic pattern. Where the amount of overloading justifies it, permanent weighing stations follow.

William G. Klett is traffic engineer and M. J. Hoffman commissioner of highways in Minnesota.

Ohio Job Starts Biggest Scrapers and Tires

C. F. Replogle, contractor on the relocation of Ohio State Route 7, near the town of Stratton, began work in August with two Wooldridge Model OS-300 units of 34 yards struck and 41 yards heaped capacity each — the world's largest.

Carrying this load are four Goodyear Wide Base Earth Mover low pressure tubeless tires — two of size 33.5-33 and two of 37.5-33 — likewise breaking size records. The scrapers were shipped bare from California, and the tires mounted at the job site under supervision of Goodyear engineers.

Power for the big diggers is supplied by a pair of MRS No. 200 special tractors, giving each unit a normal 400 h.p. rating; but it is noted that this can be stepped up to 600 h. p. by the addition of turbo-chargers, and to 800 h.p. by a super-charger. Tractor drive wheels have tubeless tires, size 29.5-29. Loads of 100,000 lbs. can be moved by such an outfit.

The Goodyear Company calls attention to the fact that while it has made Wide Base Earth Movers for some time, this application marks the first tubeless, as well as the largest of all tires for earth moving equipment. The 37.5-33's, weigh around 2000 lbs. each, and are now in regular production.

● One of the 41-yard scrapers with 37.5-33 and 33.5-33 tubeless tires on Ohio State Route 7.

● Crawlers round a corner of a 250-acre field as they pull world's largest plow which is cutting furrows 5½ to 6 ft. deep.

Four Tractors Pull Giant Plow

● Rancher Francis Griset is beyond his depth as he stands in 6-ft. furrow.

THE world's largest plow is cutting literally man-sized furrows in Griset Bros. Ranch Del Mar, Del Mar, Calif.

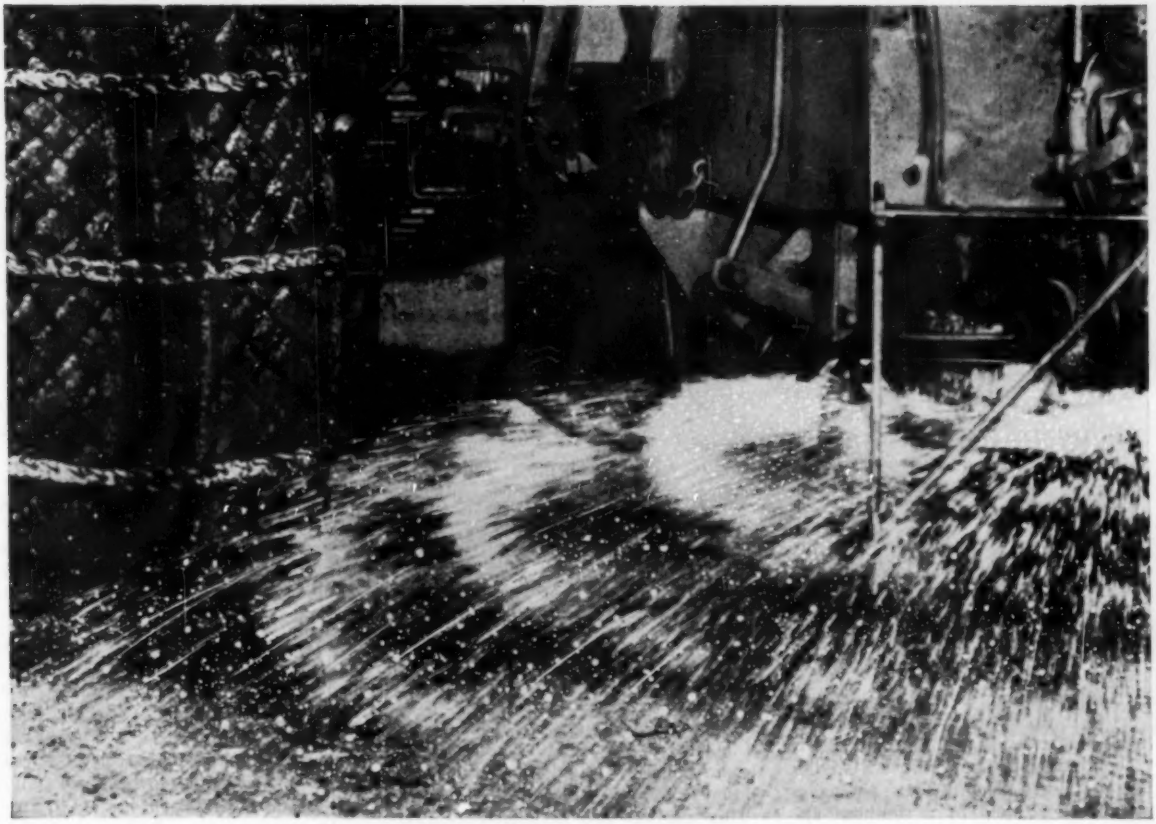
The plow was built back in the 1930s by Post Brothers Manufacturing Co., of Santa Ana, Calif., after flash floods had deposited barren sand atop fertile Southern California farm lands. The plow was designed to penetrate 5 to 6 ft. deep, bringing the fertile soil to the surface again and burying the silt and sand. But five tractors couldn't pull the 23,000-pound plow at depths below 3½ ft.

Today, the plow is at last working at the depths for which it was designed. It is cutting furrows 5½ to 6 ft. deep in a 250-acre field. Pulled by four crawlers, three of them Internationals — a total of 540 drawbar horsepower — it plows about an acre an hour at a cost of only $25 per acre. The pace is as fast as a man can walk, the tractors running at full throttle in their lowest gear range.

The Griset Brothers expect this deep plowing to make this field the most fertile on the ranch. Later, they will give the same treatment to the remainder of the 1,000 acres on the ranch.

● Straight and true, crawlers pull huge plow across 250-acre field of Ranch Del Mar, near Del Mar, California.

DOW



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Speed isn't the only advantage of Peladow. It pleases the budget, too. Because it is practically anhydrous, it contains some 20% more effective solids than conventional flake forms of calcium chloride. It can be shipped in bulk, which eliminates package costs and results in substantial savings in transportation costs. Bulk Peladow can be stored in conveniently located closed bins for fast loading of trucks. It's easier to handle with mechanical equipment, resulting in lower labor costs and faster application. Also available in 100-pound moisture-proof paper bags. For fast ice control at low cost, contact Dow for Peladow shipping and handling information.

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. . . for more details circle 195, page 16

Mackinac Straits Bridge

Substructure Design and Construction

By JOHN C. KING and O. H. MILLIKAN
Chief Engineer and Engineer, respectively, The Prepakt Concrete Company

Gorges under straits channel complicated the problem of planning world's longest suspension bridge. Over 450,000 cubic yards of concrete is involved in record-breaking operation.

THE Straits of Mackinac, five-mile-wide water barrier between Upper and Lower Michigan, will be bridged by late 1957 with a 26,444 ft. structure which embodies a 17,918 ft. steel section including an 8,614 ft. suspension bridge, the world's longest. The center suspension span of 3,800 ft. is second only to the 4,200 ft. Golden Gate span in length. The suspension system is flanked by a southern approach consisting of 16 steel deck-truss spans from 160 to 560 ft. in length and 486 ft. of fill and viaduct. The north approach will have 12 steel deck-truss spans totaling 3,610 ft. plus 7,791 ft. of fill, viaduct and causeway.

Awards of contract were made in 1953 to Merritt-Chapman & Scott Corporation for construction of the substructure consisting of 33 piers and to the American Bridge Division of the U. S. Steel Corporation for the superstructure. The Prepakt Concrete Company is assisting Merritt-Chapman & Scott in the placement of approximately 450,000 cu. yd. of Prepakt concrete in the bridge piers. Construction started in May, 1954.

When one sees the magnificent finished bridge, it will be easy to miss the story of achievement represented by the less glamorous substructure — and perhaps to miss the significance of the geologic, engineering, and construction skills required for investigation, design, and construction of the substructure. This part of the structure is somewhat comparable to an iceberg in that only a small part of the total concrete is visible.

The suspension bridge crosses a deep gorge under the main channel. In locating piers for the main suspension towers, the designers selected the minimum suspension span length commensurate with practical and economical construction to bedrock. The 3,800-ft. span permitted placing of main piers on the edges of the gorge about 200 ft. below water surface. This location also permitted location of the massive cable anchorage piers on much shallower bedrock, 86 ft. for south anchor and 70 ft. for the north anchor.

Crosses Submerged Gorge

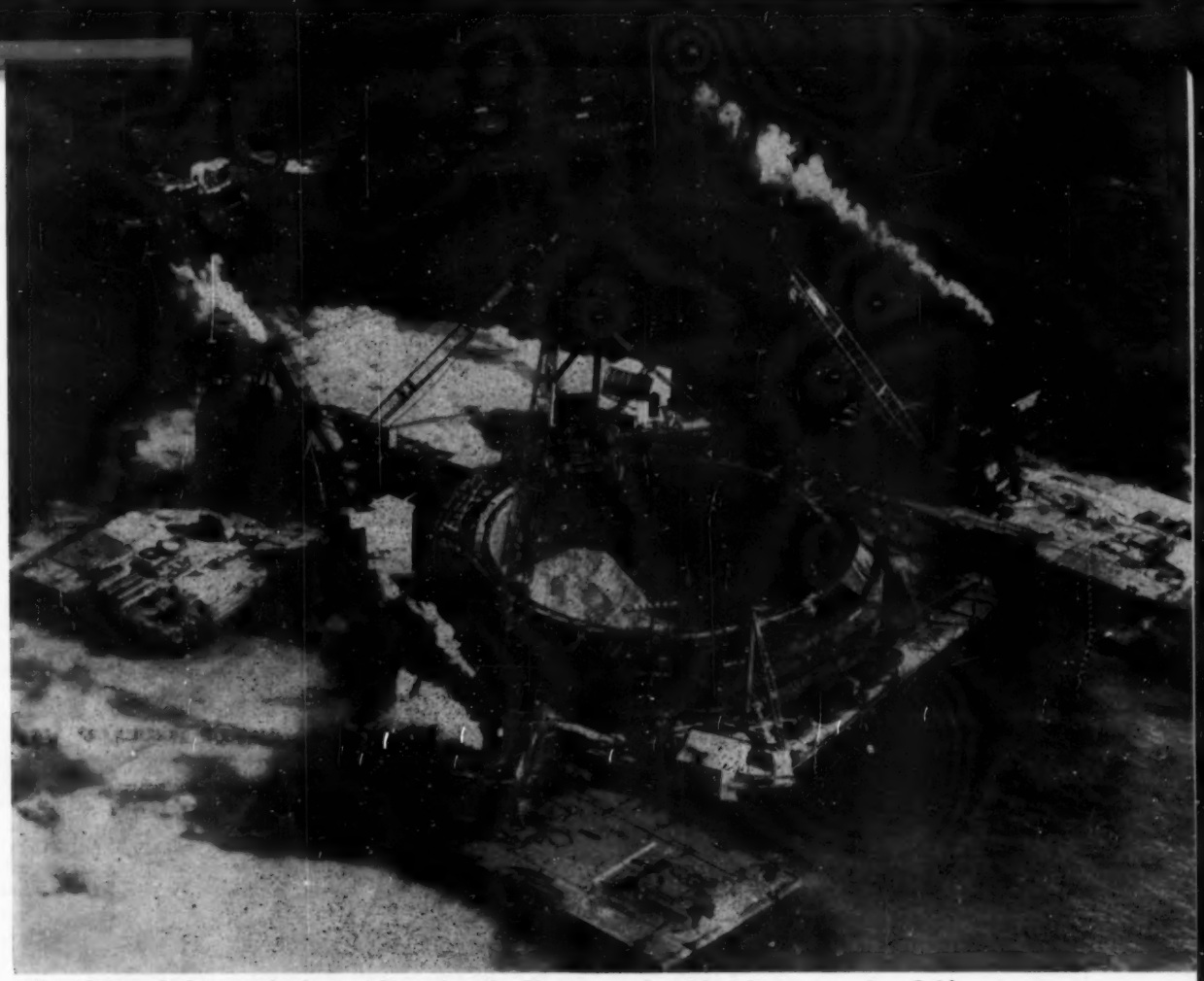
The south approach crosses another but shallower gorge. In this area bedrock is at depths to 175 ft. with half or more being overburden. To economize on pier construction, 7 piers across this gorge were placed on 14-in. 117 lb. H-piles driven to refusal. Concrete in these piers extends 10 ft. into overburden. All other piers, except No. 34 on the north approach, are founded on bedrock. Pier 34 was also placed on steel H-piles.

Geologic investigations at the site revealed the foundation to be brecciated rock. Laboratory compressive tests and "in-place" load tests established that the rock could safely support at least 60 tons/sq. ft. Anticipated maximum load from the bridge is only 15 tons/sq. ft. including dead load, live load, wind load, and ice pressure.

After reviewing latest information on ice pressure and studying ice conditions at the Straits, a very severe ice pressure of 115,000 lb. (65,000 lb. for circular surfaces) per lineal foot of pier width at the water line was adopted for design. This assumed loading is considerably greater than normally used for design purposes and is five times greater than any recorded pressures.

Construction of the 34 foundation piers which carry the 66,500-ton superstructure will require placement of about 450,000 cu. yd. of concrete, 80% of which is under water. Placing of concrete by the Prepakt method was selected because of greater economy, speed and flexibility of operation. Prepakt concrete is made by preplacing coarse aggregate in cofferdams, caissons, or forms, then consolidating the stone into concrete by pumping all voids completely full with Intrusion mortar.

The two main suspension tower piers, Nos. 19 and 20, were constructed of double-walled circular steel caissons 116 ft. in diameter, the bottom being made into a cutting edge by tapering the inner wall to diameter of the outer wall. The lower sections of the caissons were constructed on dry land then floated to the site. Caissons were maintained in position during sinking by a corral of special anchorage towers around each caisson. Each corral consisted of a group of 9 or 12 20-in. steel pipes long enough to extend 11 ft. above water surface when resting on the overburden. These pipes were positioned on three sides of the caisson location, then a 12-in. 74-lb. H-pile was driven to refusal in each pipe. The inside of each pipe was then filled with Prepakt concrete. After the caisson had been floated into place, anchors were placed on the fourth side. Anchorages were braced with 6-in. pipe struts welded to the larger pipe.

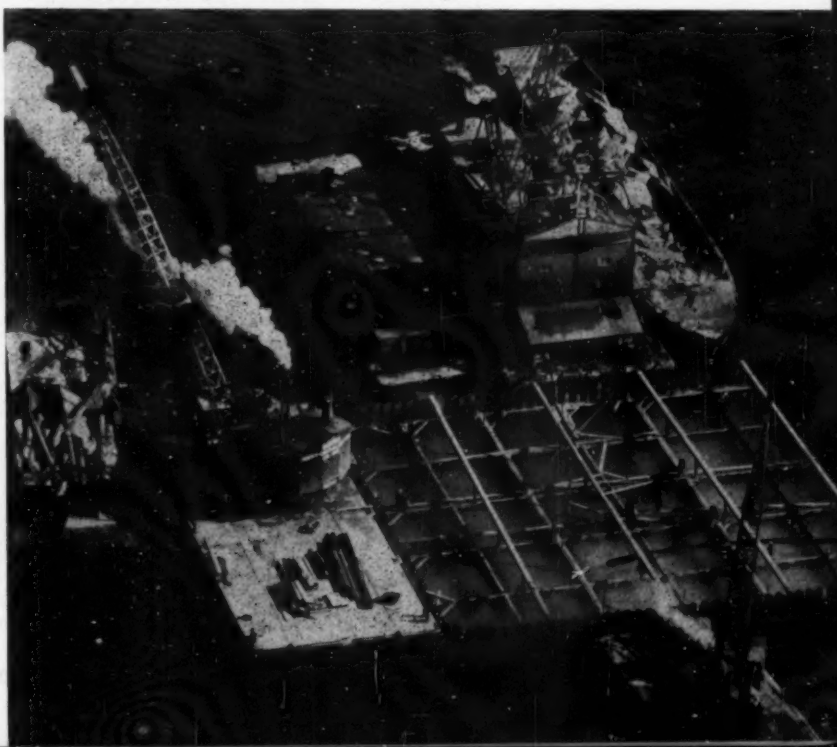


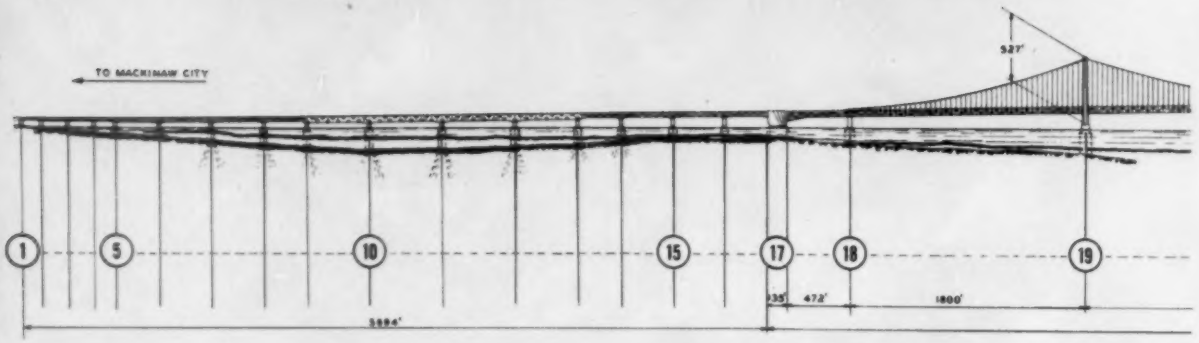
● Derrick boats dredging overburden in sinking caisson for Pier 19 to rock 206 ft. below water surface. Quick aggregate placement stabilized caisson and minimized storm damage.

To sink the caissons through overburden to bedrock, the hollow walls were first filled with water, then with stone, and finally converted to Prepakt concrete. Additional caisson sections were added and overburden dredged from the caissons as sinking progressed. After being founded on bedrock, all overburden inside the caissons was removed. They were then filled with coarse aggregate which was consolidated to Prepakt concrete; there being 75,000 cu. yd. in each pier. The main piers were topped off 8 ft. below water surface. Two 38-ft. diameter shafts were constructed on each main pier to Elev. +25 to support the steel towers.

Cable support Pier No. 18 was built by means of a rectangular caisson box containing 21 digging wells. This was also sunk by successively filling the space between the digging wells with water, stone and Prepakt concrete. Overburden was dredged through the open wells. After reaching bedrock at 130 ft. below water surface and removal of all overbur-

● Intrusion mortar production and pumping in full swing on Pier 22, the north cable anchorage. Covered barge-load of cement-Alfesil is seen on left of Prepakt plant barge, "Algonquin," with sand barge on right.

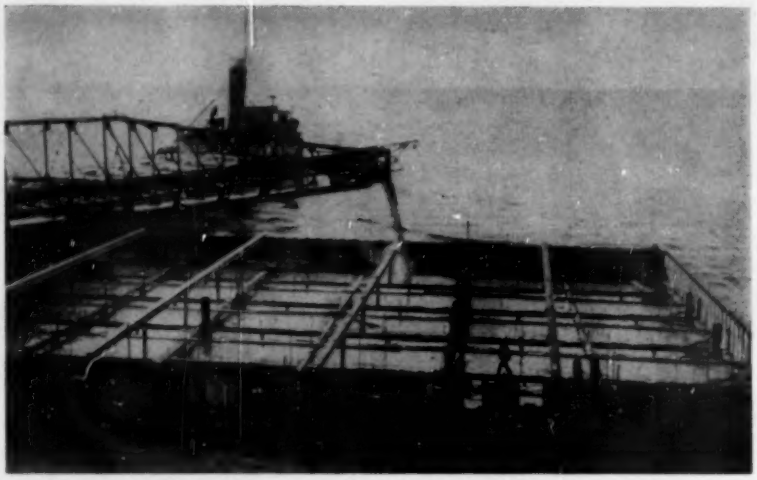




● Full profile of world's longest suspension bridge together with

den, a concrete seal was placed in the bottoms of the digging chamber and in the 21 digging wells. The well pipes were then cut off above the seal and the pier completed by filling the caisson with stone and consolidating to Prepakt concrete. This pier contains 24,000 cu. yd. of concrete.

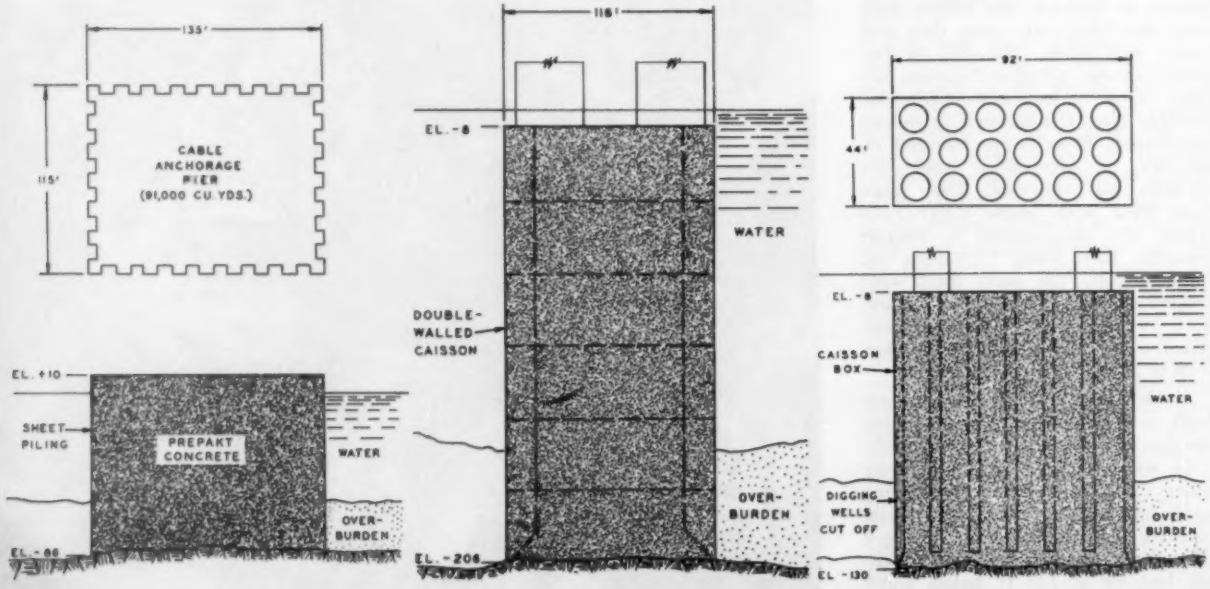
The cable anchorage Piers, Nos. 17 and 22, were built by driving piling to bedrock, digging out the overburden from the cofferdams and placing Prepakt concrete. These piers are 115 by 135 ft. and extend 118 ft. above water. Each pier contains 91,000 cu. yd. of Prepakt concrete. Frameworks for the cofferdams were fabricated in three sections and assembled after positioning. Cofferdam frames were anchored to 14-in. 117-lb. H-piles driven to refusal. MZ-27 sheet piling was used for the skin section and was driven by a McKiernan-Terry 10B3 steam hammer. The sheet piling extended 11 ft. above water surface to freeboard. The remaining piers were also built of steel sheet piling around steel frames.



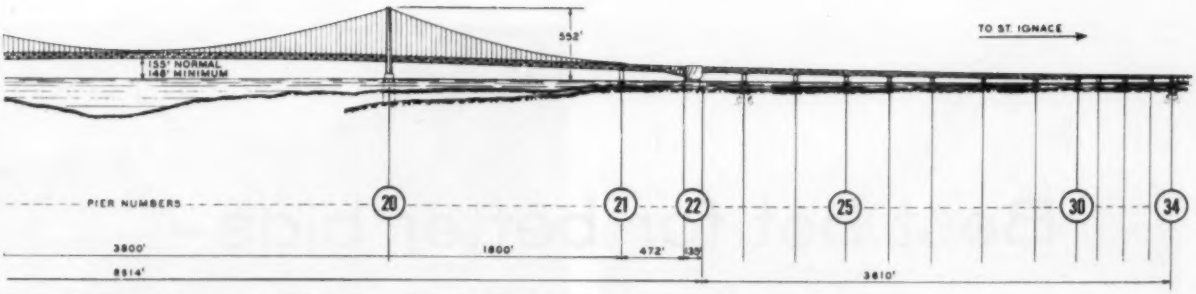
● Cofferdam for cable anchorage pier. Crushed-stone aggregate being placed by a boom from a large self-unloading boat. Intrusion pipes have been set in place in preparation for pumping of mortar.

Rapid placement of Prepakt concrete is possible because all coarse aggregate, over 60% of the total concrete volume, is preplaced without mixing and is not subject to the speed limitations of concrete mixers.

Coarse aggregate for the piers was crushed dolomite obtained from a



● Cable anchorage Piers 17 and 22; main suspension tower piers 19 and 20; cable support Pier 18.



approach spans, with pier numbers shown for reference to text.

quarry on Drummond Island. It was graded from ¾ in. to 5 in. in size. Stone was delivered to the large piers from 10,000 to 15,000 ton self-unloading boats at rates from 2,000 to 2,500 tons per hour. For the smaller piers, stone was deposited by clamshell buckets from barges.

Intrusion mortar for filling the voids in coarse aggregate is composed of portland cement, Alfesil (a finely divided siliceous material), sand, water, and Intrusion Aid, the latter a patented admixture that makes the technique possible. It provides fluidity at low water-cementing materials ratios, delays early stiffening and compensates for setting shrinkage. Intrusion mortar will displace water from the aggregate voids without dilution, making underwater Prepakt concrete indistinguishable from that made in the dry.

To fill all voids in the aggregate and consolidate it, mortar is pumped through vertical 1¼-in. steel injection pipes spaced at 10 to 20-ft. intervals each way. These pipes are placed in advance of the aggregate and withdrawn as the mortar rises. Depth of mortar is observed through a series of slotted pipes known as sounding wells and the mortar level kept uniform by controlling the time of pumping through each injection pipe.

Intrusion mortar was generally pumped simultaneously with placing of stone. However, the mortar surface was always maintained at least 5 ft. below the top of the stone, except when completing a pier. Thus when mortar pumping was stopped, the cold joint was protected by several feet of stone and cleaning of the joint was not necessary as any dust washed from aggregate subsequently placed did not reach the joint but was dispersed harmlessly throughout the upper inches of stone. At the cold joint, stone was partially embedded in hardened motar and partially in the fresh mortar, making a well-keyed joint completely free of rock dust and essentially free of laitance. Elevation of mortar below the top level of the stone was not of too much concern except that in sheet-piling cofferdams the mortar surface was maintained at not more than 20 ft. below stone surface to keep form pressures within allowable stress limits of the sheet piling.

All batching, mixing and pumping equipment necessary to consolidate 250 cu. yd. of aggregate per hour was located on one barge, the 50 by 150 ft. "Algonquin." As no coarse aggregate was processed by this plant, the barge was smaller, less costly and easier to maneuver than required for a conventional floating concrete plant. Equipment includes a revolving crane with clamshell bucket, a complete cement-Alfesil-sand batching plant, Intrusion mortar mixers and pumps, air conveying equipment, and electric power and compressed air plant.

Sand was delivered by barge and transferred by clamshell to a bin over the batching plant. Bulk cement and Alfesil were moved to the job in covered steel barges, and transferred to the batching plant by pneumatic conveyors. The "Algonquin" normally worked from a position between the sand and cement-Alfesil barges. As the Intrusion mortar was batched and mixed, it was fed into pumps which forced it through a network of hoses and steel injection pipes into the aggregate.

Contributing to the early completion of the bridge, the flexible material transfer and pumping lines permitted uninterrupted work during much of the rough weather experienced, by merely anchoring the barges a short distance from the caissons. Conventional concreting in this rough

(Continued on page 104)

● Artist's phantom view of piers extending to bedrock for main suspension cable towers. Under-water depth 200 ft.

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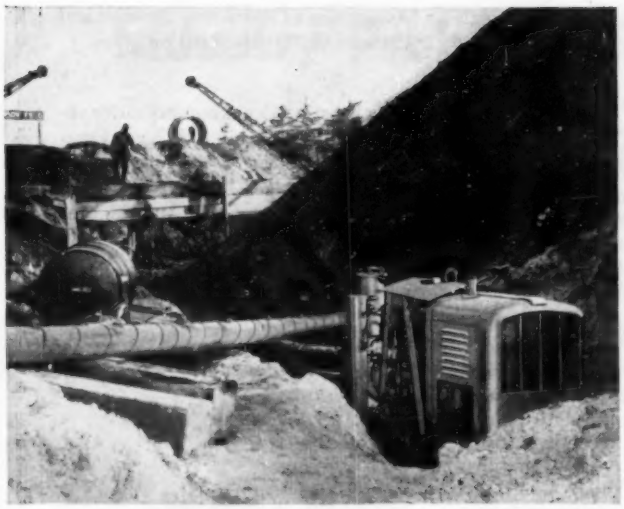
No matter where your contracts take you, you'll find GM Diesel distributors ready to supply fast service and quick delivery of low-cost factory parts. Check your local distributor today for full details on dependable, low-cost Diesel power for your equipment, or write direct for more information.

PURCHASED 23 GM DIESELS SINCE 1947

This LeTourneau-Westinghouse Tournapull is part of an earth-moving fleet used by the Lone Star Steel Company of Lone Star, Texas. The Company, one of the largest producers of steel in the Southwest, has been a consistent user of General Motors 2-cycle Diesel engines in several different kinds of earth-moving, construction and mining equipment for better than seven years.

GM
GENERAL MOTORS
DIESEL POWER



SAVING $170.00 A MONTH IN FUEL ALONE

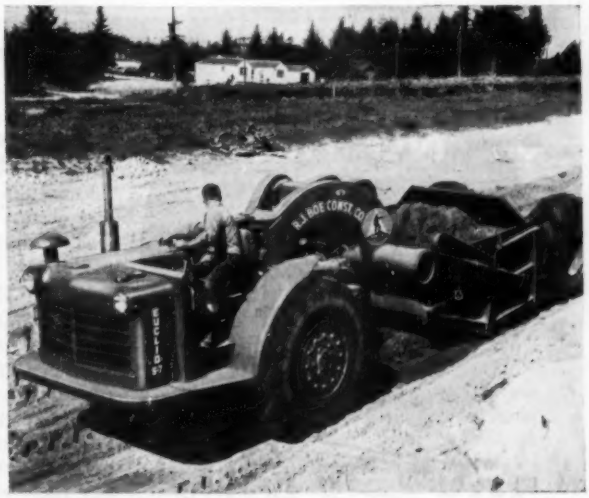
United Construction Company cut fuel costs over 60% and reduced maintenance costs when they *switched* from gasoline to GM Diesel power on their Moretrench pumps. The GM Diesels worked 24 hours a day, 7 days a week—eliminated stops formerly required to pull and service spark plugs every three days and to replace them every three weeks.

13,000 HOURS—NO REPAIRS

General Contractor A. H. Famularo bought this GM Diesel-powered Northwest 25 Crane in April 1947. In 13,000 hours he never had an injector out, never touched the head or pan. He burns 16 gallons of low-cost Diesel fuel in 8 hours—specified GM Diesel power "because it was economical . . . and has proved to be reliable."

25% MORE WORK; FUEL COSTS ⅓ LESS

Killough Construction Company has *standardized* on GM Diesel power for their portable rock crushing plant in Kansas. The firm uses six GM Diesels to run a hammer mill, operate conveyors and screens, a primary crusher and two shovels. One shovel, converted from gasoline to GM Diesel power, now does 25% more work on one-third less fuel cost.



"WONDERFUL PERFORMER"

This GM Diesel-powered scraper hauled nine yards every four minutes on a recent job for the R. J. Boe Construction Company. Contractor Russell Boe likes the "wonderful acceleration and trouble-free performance GM Diesel power gives me." He says, "All you need to do is keep water, oil and clean fuel in that GM Diesel and you'll get a good day's work out of it."

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. . . for more details circle 203, page 16

Personals

Paul C. Sanders passes

PAUL C. SANDERS, 51, vice president of Johnson, Drake & Piper International Corporation, New York and Minneapolis construction firm, died October 27. He had been associated with the company since 1924, was general manager of Drake-Merritt, a joint venture with Merritt-Chapman & Scott Corporation, of New York, on large defense projects. Mr. Sanders was a specialist in overseas construction.

NORMAN E. LANT, noted Urban Engineer of the Louisiana Department of Highways, has retired after 32 years with the Department. Lant designed or supervised the design and construction of practically all major highway bridges in Louisiana during the last three decades.

In recent years, he has been a leading planner of some of the largest urban projects ever undertaken in Louisiana — including multi-million dollar expressways, overpasses, urban highway extensions and bridges.

CHARLES R. WATERS, formerly District Engineer at Buffalo for the New York State Department of Public Works until his recent retirement, has become an associate of DeLeuw, Cather & Brill, Consulting Engineers, and a special consultant to DeLeuw, Cather and Company. He will be in charge at the recently organized Buffalo office of these firms, at 47 West Huron Street, Buffalo 2, N.Y.

CARL W. BROWN, 68, former chief engineer of the Missouri state highway department, died recently after a long illness. He served as president of the Mississippi Valley Conference of State Highway Departments, president of the American Association of State Highway Officials, and president of the American Road Builders Association.

BURTON F. MILLER, newly appointed deputy executive vice-president of American Road Builders' Association, Washington, D. C. A 20-year ARBA staffer, Miller manages the Association's Contractors Division and Division of Materials and Supplies.

ALBERT J. WEDEKING, executive director of the Indiana Toll Road Commission, was elected president of the American Bridge, Tunnel & Turnpike Association at its recent annual convention in Atlantic City, N.J. He succeeded C. Ellison Kaumeyer, secretary-treasurer of the Niagara Falls Bridge Commission.

Albert J. Wedeking

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Industry Problems Studied By AGC Board Meeting

PROBLEMS faced by the construction industry in meeting the expanding demands of the most dynamic economy the country has ever known, were considered by the Governing and Advisory Boards of The Associated General Contractors of America at their midyear meeting at Minneapolis, Minn. Among the meeting highlights were:

• *Day Labor.* A restatement of the association's vigorous opposition to day labor operations by agencies such as the Tennessee Valley Authority, and its negotiation of labor agreements.

• *Work Stoppages.* A recommendation that contractors make work assignments strictly in accord with the Procedural Rules of the National Joint Board for the Settlement of Jurisdictional Disputes in order to avoid contributing to work stoppages.

• *Subcontractor Legislation.* A determination to seek defeat of legislation pending in Congress which would require general contractors to name their subcontractors for mechanical specialty work in bids on federal projects, described as a movement to destroy the single contract method in which complete responsibility for construction of a project is centralized in a qualified general contractor.

• *Oppose Davis-Bacon Extension.* Recommendation that proposals for extension of the Davis-Bacon Act provisions to highway construction, and to broaden the scope of the act, be vigorously opposed.

Growth of Market

• *Industry Growth.* President Koss, in opening the sessions, described the industrialization and growth of the country since World War II and asserted that the construction market "has never been so big, or so many in it," with keen competition continuing. He outlined some of the major accomplishments of the AGC in combating day labor during the depression of the '30's, in later administering the National Recovery Act code, and in dealing with governmental controls of all types during and after the war. Mr. Koss said the association's services have been invaluable to its members. Today's conditions, he added, place more emphasis on work by the local chapters, "but without any qualification, the national association and the chapters are dependent upon each other."

• *Serious Problems.* Managing Director H. E. Foreman, in presenting his report of AGC activities since the last convention in March, stated that although the prospects are for a continued volume of construction at record levels, "general contractors do now, and will face serious problems in the future" in carrying out their work. He added that the work load of the AGC and its chapters has become heavier with the growth of construction "in complexity, size, importance, and recognition of its contribution to the growth and development of the nation and its communities."

• *Chapter Strength.* Executive Director James D. Marshall also stressed the dependency of the association on the strength of its chapters and branches, and urged careful appraisal by chapters of their organizations to determine the adequacy of their facilities. "Very keen organizations are required throughout the country," he added. Chapters having joint cooperative committees with state highway departments reported beneficial work, including insertion in contracts of an alternated "changed conditions" provisions to protect contractors.

• *Round Table Discussion.* Subjects discussed at a round table meeting, presided over by chairman J. L. Ewell, Ewell Engineering and Contracting Co., Lakeland, Fla., included the shortage of engineers; improvements in road and bridge specifications in national forests and parks; public liability and property damage insurance; and the new federal-aid airport program calling for $500 million of construction in four years.

• *Accident Prevention.* Reporting on the national program conducted in the past six months, Ira H. Hardin, Ira H. Hardin Co., Atlanta, vice chairman of the Accident Prevention Committee, told the board meeting that continued efforts are being directed toward promoting chapter accident prevention programs in areas that are "lagging behind."

Other subjects reported were: the national office expects 2,000 — or 25% increase — in the number of member firms taking part in the AGC safety program; and new AGC forms, including superintendent's accident investigation report and job start report cards to notify insurance carriers of new jobs, are available.

• *Apprenticeship.* AGC district subcommittees are beginning to gather statistics and initiate local programs to promote the indenture of more apprentices in construction trades. Stepped-up programs are already in progress in some districts. In others, there is complaint of "lack of cooperation" from certain local unions in indenturing apprentices.

The committee on apprenticeship endorsed the use of related training correspondence courses when regular class attendance is impossible under certain conditions. It also expressed need for more movies, slides, posters, and other visual aids from the Bureau of Apprenticeship.

• *Education.* The Education Committee reported that 798 AGC members, in answer to a survey, employ 4,006 civil engineers. An additional 13,000 civil engineers will be needed within three years, and over 20,000 within five years.

Other actions taken by the committee included: the continued study of the curricula of engineering colleges, recommendation to the Executive Committee (which was later approved) that the AGC establish a joint committee with the ASEE; the recognition of numerous local education committees that have been established by AGC chapters; and resolutions calling for (1) continued assistance to the Highway Research Board's committee on highway engineers, (2)

(Continued on page 99)

Economics of Prestressed Bridge Design

By H. Kent Preston

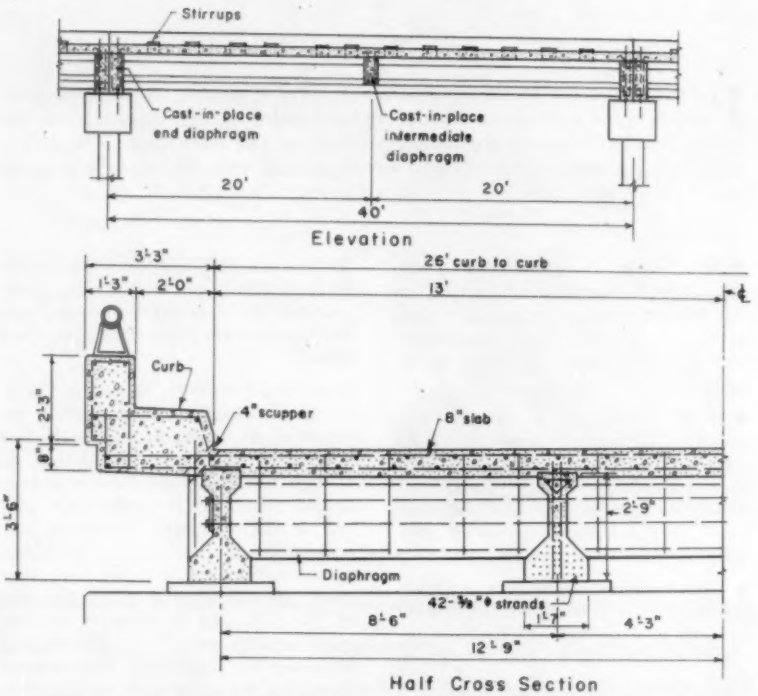
Engineer, Construction Materials Division
John A. Roebling's Sons Corporation

Your article, "Kansas First Prestressed Concrete Bridge," October, 1955, asked for comments and suggestions on the items discussed under "Author's Comments." The undersigned is strongly in favor of standardized sections and also leans toward a poured-in-place deck.

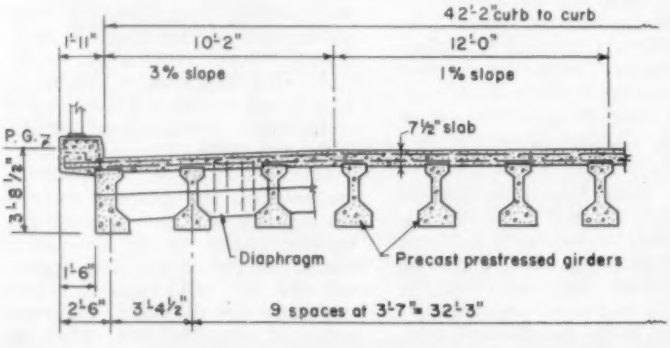
Our own experience with prestressed concrete bridges indicates that the design developed for the Garden State Parkway prestressed concrete bridges in New Jersey is about the most economical available up to now, and it incorporates both of the desirable qualities mentioned above. Although the diaphragms in the Garden State Parkway structures were prestressed, similar structures are now being built with simple reinforced concrete diaphragms and the writer agrees that these are adequate for this type of structure. In structures like that described in the article, transverse prestressing is essential.

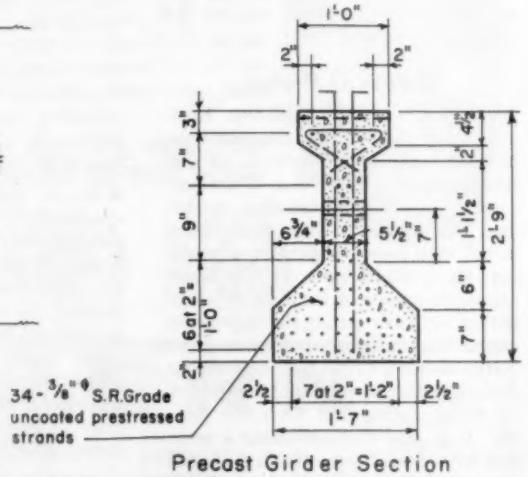
Details of typical Garden State members are shown on the enclosed prints of Sheet 212 from Section 11, and Sheet 20 of Great Egg Bridge on Section 11. It should be noted that the same girder cross-section can be used for all spans. The variation in moment due to change in span and live load can be provided for by changing the spacing between the prestressed girders and by varying the number of strands (the prestressing force).

Once casting beds are available the pre-tensioned designs should prove cheaper than reinforced concrete or structural steel designs. This is demonstrated by the fact that this type of bridge was used on the Garden State Parkway in every case where it was offered, although it had to be bid as an alternate in competition with so-called "standard designs." A comparison of pre-tensioned and post-tensioned costs can be found in the July, 1955, issue of ROADS AND STREETS in the article titled — "Prestressed Concrete Costs."



● Pile bent span, prestressed beam deck, Great Egg Bay Bridge on the Garden State Parkway in New Jersey.





● Prestressed concrete deck details, Contract 31, Garden State Parkway.

AGC Studies Problems

(Continued from page 97)

AGC sponsorship of the 1956 Military-Industrial Conference, and (3) the preparation of a brochure outlining advantages for professional engineers in construction.

● *Labor Committee.* The Labor Committee opposed proposals to extend the Davis-Bacon Act to federal-aid highway construction, and strongly objected to twin AF of L bills S. 1285 and H.R. 4566 which would expand wage predeterminations to include health, welfare and pension benefits, require payment of time and a half on federal-aid highway work and otherwise violate sound industry practices. It also opposed any crippling amendments to the Taft-Hartley Act, particularly those in pending bills S. 1269 and H.R. 4565.

Also included in the committee report, made by Lester C. Rogers of Bates and Rogers Construction Corp., Chicago, were: a three-point proposal to solve labor problems arising between visiting contractors and local chapters; plans to publish soon the revised booklet on "Federal Labor Laws Affecting Employment in Construction;" and the issuance by the national staff of a "labor summary bulletin" which will contain all important labor developments on a given subject with a cross reference to the original labor bulletin for details.

● *Specifications.* Robert W. Long, Long Construction Co., Kansas City, Mo., vice chairman of the Contract Forms and Specifications Committee, recommended "vigorous action" for continued use of bid bonds on federal construction work; the continued protection for general contractors who have Corps of Engineers contracts suspended; more field meetings at Corps of Engineers' division level; and further efforts to eliminate the Bureau of Yards and Docks contract provision which permits the Navy to increase wage determinations after the award of a contract without increasing payments to the contractor.

Concerning Air Force Academy Construction Agency contracts, members asked for modification of "catch-all" phraseology in clauses which holds the contractor financially responsible for the agency's mistakes, and for the sub-surface conditions not known at the time of bidding.

In a day-long session prior to the board meeting, the Secretaries' and Managers' Council heard welcoming addresses by president Koss, vice president Rooney, managing director Foreman and executive director Marshall.

J. George Robinson, executive secretary of the AGC of Missouri, reported to the meeting as chairman of the council's Accident Prevention Liaison Committee; and Earle W. Devalon, manager of the Colorado Contractors Association, Inc., reported on activities of the Public Relations Committee of interest to chapters.

Assistant executive director C. S. Embrey explained the proposed revision of the membership application form, and several suggestions by chapter managers were transmitted to the Membership Committee. It is planned to appoint a council liaison committee to aid the Membership Committee in developing the form.

● *Other Developments* in the full council meeting included: the appointing of committees to develop a survey form of chapter data for council members and to nominate council officers for 1956; and approval of resolution commending Northeastern chapters for their prompt services in helping to restore and rehabilitate areas hit by hurricanes in August.

The Highway and Heavy Division secretaries reviewed the recent meeting of the Western Association of State Highway Officials, force account work by the Air Force and labor relations.

Other officers of the council are Curtis Bell, Corpus Christi, vice chairman of the building chapters; W. D. Shaw, Los Angeles, vice chairman of the highway and heavy chapters; and Paul H. Hinds, Miami, secretary.

Texas needs 1,748 miles more multi-lane roads

In anticipation of an enlarged federal highway program, concentrated on the national system of interstate highways, the Texas Highway Department has issued a summary of its progress in multi-lane rural road construction.

Divided highways totaling 743 miles outside of cities are now completed or under contract, and 2,298 miles more of such roads are needed to move traffic safely and efficiently, according to D. C. Greer, state highway engineer. About 550 miles more will be added to the system when the current programs of work have been awarded and completed.

The state needs $612 million worth of such roads immediately according to Greer and by 1955, $800 million worth of such roads should be completed, bringing the Texas investment in the multi-lane facilities outside of cities to more than $2 billion.

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. . . for more details circle 246, page 16

How Would You Do It?

1. Grader has begun to work earth over toward the pipe, using earth dropped by the heavy scrapers in turning around.

One of a Series

ALWAYS a problem in grading for a new highway is the one of securing proper compaction around and over culvert pipes installed in the midst of the grading and rolling work.

On the recent grading job on Texas Route 199 north of Fort Worth, the concrete pipe culverts were placed by Austin Bridge Company. This firm backfilled up to the centerline of the pipe, compacting the material with pneumatic tampers in accordance with the usual specifications.

The grading work, under a subcontract held by Thomas and Castell of Mabank, Texas, included completing the filling around and over the pipe. Rather than risk damaging the pipe by rolling with sheepsfoot rollers and heavy tractors or by bringing the heavy earthmoving scrapers too close, the work was turned over to a Galion motor grader.

2. Sprinkler truck takes a turn, followed by pass of blade to mix in the moisture.

3. Six or seven passes, in all, and pipe crown is covered. Another foot of material, and then the scrapers and dozer can bring the fill on up without endangering the pipe.

As pictured here the operator stopped occasionally in the midst of other work and in conjunction with passes of the sprinkler truck for moisture, intermixed material along either side of the pipe to secure the desired moisture content. Then with additional blade passes, the operator laid the material in successive thin layers against and over the pipe, following each blade-in pass with passes to secure compaction with the tires on the near side of this machine.

This method was continued until a foot or more of material was in place over the top of the pipe — after which scrapers filling, spreading and rolling proceeded over the culvert in the direction of the highway axis.

The Cyclic Evolution of Planets

By Halbert P. Gillette

THIS is the third of a series of articles ascribing correlated cyclic phenomena to ionostreams between the sun and the earth and other planets. The first was published in December 1954 under the title of Weather Cycles and Their Causes, which announced that the third article would discuss the genesis of the earth and other planets by the emission of solar ionostreams.

An ionostream, as here considered, is a spiraling tube of electrified corpuscles impelled by solar radiant waves, having magnetic polarity because of rotation of its electrons, and cohesion because of magnetic attraction between similarly charged ions as well as by electrical attraction between opposite charged ions.

The next article of this series will discuss ionospherical shells, each of which will be called an ionosphere. They are the spherical analogs of the tubular ionostreams which might be called ionotubes. The sun and at least five visible planets are centers of several concentric ionospheres.

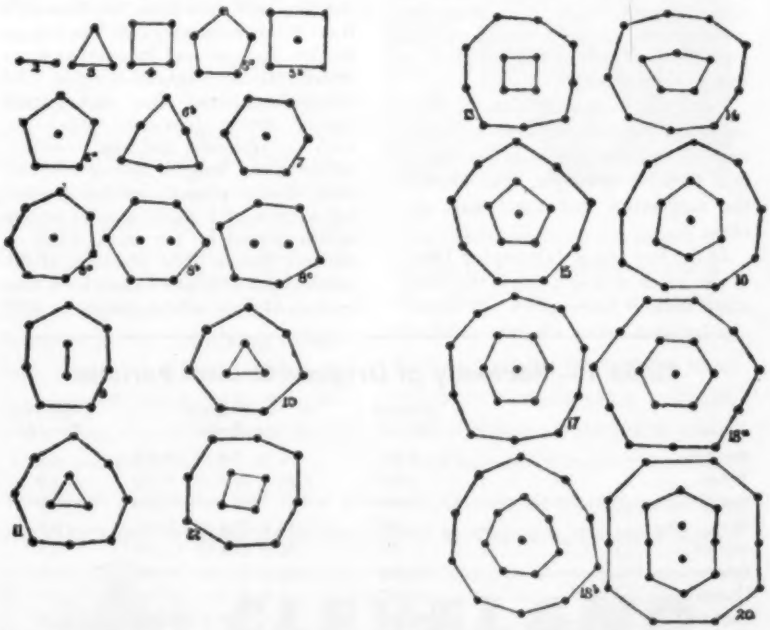
The first announcement of an electric theory of the cause of three different kinds of correlated cycles was published by Prof. Elias Loomis in the American Journal of Science and Arts, September 1870 and April 1873, from which a long quotation was abstracted in the article on Astronomy in Encyclopedia Britannica, 9th and 10th editions. Speaking of the so-called "11-year" cycles in sunspot numbers, in frequency of aurora and in variations in terrestrical magnetism, Loomis said:

"If now we inquire as to the probable connection between these three classes of phenomena, we cannot suppose that a small black spot on the sun exerts any direct influence on the earth's magnetism or electricity; but we must rather conclude that the black spot is a result of a disturbance of the sun's surface, which is accompanied by an emanation of some influence from the sun, which is almost instantly felt upon the earth, in an unusual disturbance of the earth's magnetism, and a flow of electricity, developing the auroral light in the upper regions of the earth's atmosphere. The appearances favour the idea that this emanation consists of a direct flow of electricity from the sun." Then to explain how such a current could travel through a seeming void for 93 million miles, he invoked, rather vaguely, "vibrations of a rare ether."

Since the electrons that constitute an electric current were not experimentally discovered till 1897, by J. J. Thomson, Loomis was unable to use his hypothesis to convince many scientists. And even after 1897 the existence of sun-to-earth conductors seemed impossible. However in 1905 S. A. Arrehenius suggested that the pressure of light drives solar electrons into the earth's atmosphere causing aurora and magnetic effects. Yet that important inference was not enough, for it gave no clue to the cause of the 11.2-year cycle in sunspot numbers, nor did it indicate what sunspots really are.

To a great American astronomer, the late George Ellery Hale, we owe several important discoveries relating to sunspots. In 1908 he found that they are whirls in the sun's atmosphere and probably are magnetic, which he definitely proved by spectroscopic study in 1919, also showing that they often occur in pairs of opposite polarity that is reversed every other cycle of 11.2 years. In 1913 he had found spectroscopically that the sun is a magnet, and in 1917 he had located the sun's north magnetic pole and the approximate siderial period of the sun's axial rotation at the pole, which is of the order of 28 days.

Hale did not apply Newton's "Sec-



● Fig. 1: Geometrical arrangement of small floating magnets in a strong magnetic field.

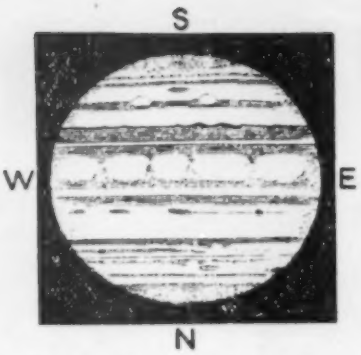


FIG. 2.—Jupiter, 1903, July 10, 2·50 a.m.

FIG. 3.—Jupiter, 1906, April 15. 5·50 p.m

ond Rule of Philosophizing," or he might have inferred the cause of the axial rotation of sunspots. That rule for guidance in seeking causes is: "In as far as possible, the same causes are to be assigned to the same natural effects." It was by applying that rule that lightning was inferred to be an electric discharge similar to the sparks from a friction electric machine. To the writer it seemed probable that rotating, magnetic sunspots are examples, on a grand scale, of Faraday's experimental discovery in 1821 that an electric current is rotated in a magnetic field. The sun has a magnetic field, and sunspots are rotating streams of ascending and descending gases charged with electrons. This Faraday principle has long been used by the writer to explain the rotation of ionostreams and is used in this and the following article to explain that axial rotation of the sun and planets, and their orbital motion as well as that of their satellites.

Newton's Research Rule 2 indicates that the cyclic changes of brightness of variable stars may be due to this Faraday principle, and likewise the magnetism that some stars disclose.

In the first article (December 1954) in the series of which this is the third, some reasons were given for believing that the sun's orbital motion toward Vega, a very bright star, may explain why the earth and other planets cause solar electric disturbances when a planet crosses a solar ionostream in longitude 290 degrees. That is approximately Vega's longitude. It was reasoned that the magnetic sun moving orbitally at great velocity through cosmic ions would become charged electrically, and thus generate its emitted ionostreams. It should be added that in escaping from the sun the ionostreams would, by magnetic interaction, arrange themselves in a geometrical system.

Figure 1. (from J. J. Thomson's Electricity and Matter, p.115) illustrates an experiment by J. R. Mayer. It shows how floating corks, penetrated vertically by magnetic needles, arranged themselves when a bar magnet was held over them. By Newton's Rule 2 the writer regards the sun as the bar magnet, and its emitted ionostreams as the magnetic needles. The writer has found that each planet causes strong harmonic subcycles, both in sunspots and our weather, whose mean lengths are one-twelfth that of the planet's orbital period; e.g. a cycle of 1/12x12 months or one month caused by the earth. Each of the four known giant planets and the inferred planet Alpha causes such subcycles. Alpha's orbital period is 672 years as shown in the first article of this series, and in Fig. 4. It causes a powerful subcycle of 1/12 of 672 or 56 years as shown by the thickness of treerings and lake varves (annual laminae of silt).

Another application of that rule was used by the writer as evidence of the existence of 12 solar ionostreams 30 degrees apart in longitude. It is the so-called "portholes" of Jupiter, shown in the accompanying Figs. 2 and 3 in the eleventh edition of Encyclopedia Britannica. These "portholes" are seen only at intervals. The dates to which Figs. 2 and 3 relate were July 10, 1903 and April 15, 1906. On the first date Jupiter was close to the longitude of the sun's axis of rotation when its north pole was nearest Jupiter. Since that axis is inclined toward the ecliptic plane, the axes of sunspots point more directly toward Jupiter than at other times. This accounts also for abnormal frequency of terrestrial aurora, magnetic storms, and destructive cyclones in the Spring and Autumn.

In the Jupiter case of Fig. 2, July 10, 1903, the earth was causing its annual sunspot maximum of July 12, as shown in the December 1954 issue of this magazine. Moreover Jupiter and Saturn then were near conjunction.

As to the date of Fig. 3, April 15, 1906, Jupiter and Alpha, also Jupiter and Neptune, were then near conjunction, as determined from a table in the November article which is here repeated as Table 2.

Newton's Research Rule 2 has also led the writer to infer that each planet acts as does the sun in its northward orbital flight toward Vega, namely that its magnetism causes it to become electrically charged; that the cosmos is the main course of the sun's electron charged, and a source of each planets charge, part of which flows to the sun through cosmic ions that form a tube encasing the solar ionostream to the planet. Unlike the enclosed solar ionostream, the cosmic ions attracted by it are not advancing. The enclosing tube is the conductor of planetary electrons to the sun.

That impelled solar ionostreams carry solid matter of much greater mass than ions is indicated by meteoric iron constantly reaching the earth, and visible in the arctic snow. It is significant that Richard E. Byrd at his winter (1933-34) camp called Little America saw each night 5 to 30 times as many meteors as he had ever seen before. That camp, it should be added, was not far from the south magnetic pole, which attracts spiralling

(Continued on page 105)

Table 1 — Harmony of Original Orbital Periods

Planet	*Present Period*	*Original Period*	*Difference Percent*
Mercury	0.241	¼ × 1.0 = 0.250	4.0
Venus	0.615	1/36 × 22.4 = 0.622	1.2
Earth	1.000	1.000	0.0
Mars	1.881	1/12 × 22.4 = 1.867	0.8
Jupiter	11.862	½ × 22.4 = 11.200	5.9
Saturn	29.458	2½ × 11.2 = 28.000	5.2
Uranus	84.013	3 × 28.0 = 84.000	0.0
Neptune	164.793	2 × 84.0 = 168.000	1.9
Pluto	248.430	3 × 84.0 = 252.000	1.4
Alpha	672.000	8 × 84.0 = 672.000	0.0

New Publications

Calcium chloride for wintertime maintenance

Most highway departments in the cold weather zones prepare thousands of tons of abrasives long before the winter season sets in. These abrasives are treated with calcium chloride and remain workable and moist throughout the cold winter weather.

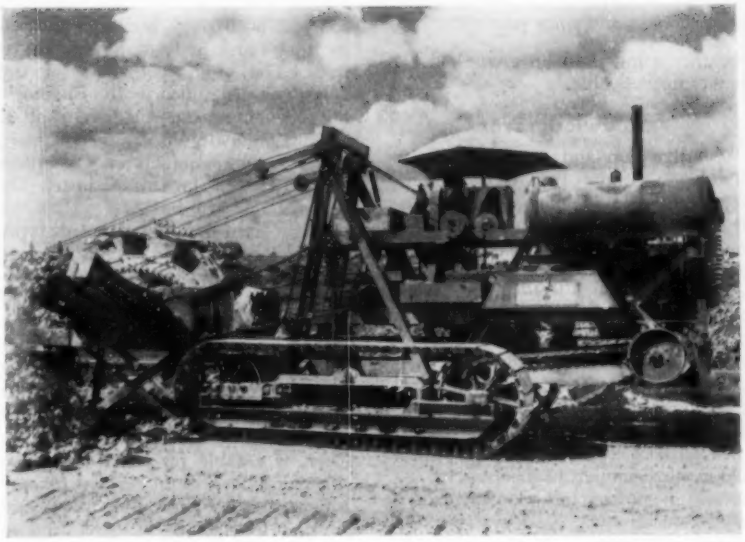
These two characteristics of treated abrasives make them most valuable during emergencies, when motorists need immediate traction on hazardous, ice covered roadways. Engineers have come to depend on the use of calcium chloride treated abrasives for positive ice control even in coldest weather.

The Calcium Chloride Institute has prepared and will send on request a copy of their Manual IM-1 "Calcium Chloride for Ice Control." It contains recommendations for treating and storing abrasives, spreading abrasives and direct application of calcium chloride in ice control operations. The manual also contains helpful tables and charts on skid test data and melting action of abrasives. Write the Calcium Chloride Institute, 909 Ring Bldg., Washington 6, D. C.

ELEMENTARY PLANE SURVEYING, Third Edition, by Raymond E. Davis; McGraw-Hill Book Co., 330 W. 42nd St., New York, N.Y.; 508 pages, $5.50.

Theory and practices of surveying, with adaptations for study of such subjects as the principles of measurement and the adjustment of observations. The book is a combined classroom text and manual of exercises for field and office, covering the fundamental relationships of surveying, the use and adjustment of instruments, the techniques of measuring and plotting angles and distances, and the practice of entire surveys.

The text has been brought up-to-date with necessary revisions and additions in such subjects as the adjustment of compass traverses, barometric leveling, polar planimeter, triangulation, state systems of plane coordinates, mine surveying, mineral-land surveying, applications of photogrammetry in route location, new types of instruments, settling a monument, aircraft jigs and field astronomy. The material on construction surveying is collected in a separate chapter. There is a new summary of tables of errors in chaining and errors in leveling.



Cleveland "140" *halves* 90-day time limit... digs 44,500 feet Florida coral rock in 45 days

Under contract to dig over 8 miles of water line trenches within 90 days, C.B.S. Excavators of Miami finished the job in just half that time using a fast-moving Cleveland "140" Trencher.

The "140" cut trench through solid coral rock for over 40,000 feet of lines in Miami's Westview Homes Subdivision and for the mile-long main connecting the system to the water plant. Trench for the 6-, 8-, 10- and 12-inch pipe was 20 inches wide and 42 inches deep. In addition to the extensive coral rock, the trenching operation was further complicated by seepage of water into the partially-dug trench in some areas of the subdivision.

"No other machine can match it," owner P. F. Chambers says of his Cleveland "140". "For its size this machine can do more trenching than any other. We use the same machine for digging utilities lines and house footings. It really does a fine job of cutting to grade."

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. . . for more details circle 191, page 16

(Continued from page 93)

weather using rigid lines would have been impracticable.*

Acknowledgments

Construction and operation of the Mackinac Straits Bridge is administered by the Mackinac Bridge Authority, Prentis M. Brown, chairman, and L. A. Rubin, secretary. Dr. D. B. Steinman of New York City is the designing engineer. J. W. Kinney is Dr. Steinman's representative at the job site. Grover C. Denny is project manager and C. E. Haltenhoff, project engineer, for Merritt-Chapman & Scott Corporation. Mered McKinzie is project superintendent and R. E. Davis, Jr. is project engineer for The Prepakt Concrete Company, subcontractor assisting in the concrete placement.

*As reported in ROADS AND STREETS, September, 1955, record performances for underwater concrete placing were set in October, 1954. The records were again broken in May, 1955, by placing 6,250 cu. yd. in 24 hours, 33,068 cu. yd. in 7 days, and 103,107 cu. yd. in 30 working days.

New hoist classification rating chart available

A new Hoist Classification Rating Chart, Issue No. 2, dated June, 1955, has just been published and released by the Truck-Body and Equipment Association, Inc. The data in the Chart were compiled by the Engineering Committee representative of all of the major hydraulic hoist and steel dump body manufacturers, members of and comprising an Industry Division within the TBEA.

This Chart, the only one of its type, has been published to provide a means of standardizing the capacity ratings and as a convenient method of comparison of hoists manufactured by the Association members. The Chart places all hoists in classes depending upon the torque rating in inch-pounds developed by the hoist around its hinge shaft. Also included in the Chart is a table for determining the size of rating of hoist needed for any anticipated use. Body dimensions and payload tonnage figures are used in the table which converts that information into the required hoist class needed for the given job.

Issue No. 2 is a new chart and brings up-to-date Issue No. 1 brought out in 1954. Copies are available from the TBEA National Executive Offices, 403 Washington Board of Trade Building, 1616 K Street, N. W., Washington 6, D. C.

Unfinished Section of Indiana Toll Road May Be Blacktop

A shortage of portland cement may result in completing the remaining 96 mi. of the Indiana east-west toll road with asphaltic concrete.

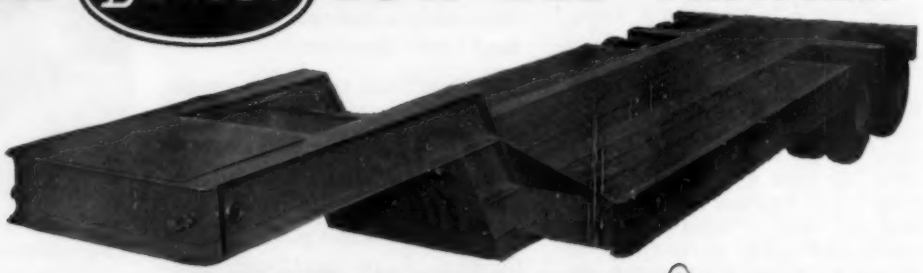
This was disclosed by Albert J. Wedeking, executive director, state toll road commission at the annual Indiana governmental conference at Indiana university.

Concerning the cement shortage, Wedeking is reported to have said, "The situation is critical, but we are determined to maintain our construction schedule, which calls for completion of the road by late next year. Portland," he added "seems more interested in its regular customers than us. We, of course are only a one-year customer."

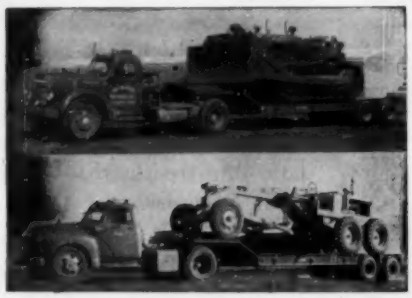
He said the commission has directed J. E. Greiner company, Baltimore to study the "possibility and practicability" of using asphalt not only on this toll road, but also, the proposed north-south Indiana toll road. Sixty miles of the E-W road has been completed with portland cement pavement.

So Light, to be so Strong

THE NEW DORSEY LOW BED TRAILER



Now, a 20-ton trailer weighing only 8,250 pounds cuts operating costs and gives busy heavy haulers more loads within legal limits. High tensile steel main channels and close-spaced all-welded cross members give extra strength to the Dorsey HTS series of low bed trailers also available in 15, 25, 30 and 35 ton capacities. Flat-type gooseneck steps up efficiency and versatility. Wheels in tandem "walk" on stub axles over rough terrain, pull easily on highways under any load.



Typical loadings show versatility of flat-type gooseneck Dorsey HTS low bed trailers which are delivered ready for work with brakes, recessed lights, tool box as standard equipment. Grader ramps are optional at extra cost.

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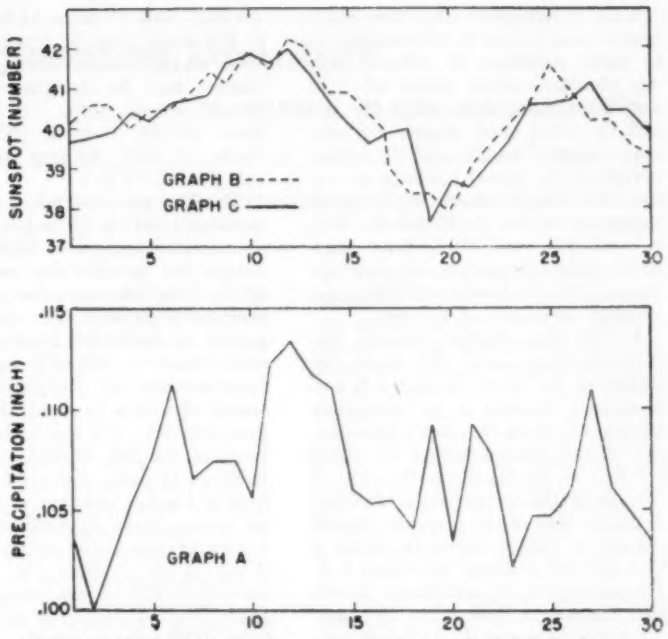
(Continued from page 102)

solar ionostreams of opposite magnetic polarity.

S. H. Schwabe, the German apothecary who, after 18 years of telescopic study, announced in 1843 the existence of the "11-year" sunspot cycle, also announced a correlated cycle of meteors. His meteor cycle has been seldom mentioned, probably because it seemed incredible. Yet in 1947 "A daytime meteor shower that peppered the earth for three months was discovered by radar." Early in May the shower was discovered as radar "pips," and continued for three months, with peaks about 11 a.m., "The meteors seem to come from about the sun, which is an astronomical effect due to the varying motions of the sun and earth." The writer disagrees with that explanation. The middle of the 3-month shower was not far from July 12 when, as shown in the first article of this series, there is a great annual maximum of sunspots, due to a solar ionostream strengthened by terrestrial electrons flowing sunward through the celestial ions encasing that solar ionostream. The existence of that ionostream was found by tabulating sunspot numbers on each calendar day for 50 years. The peak number on July 12 averaged 57% more than the minimum number 6 months earlier!

In his Astronomy (p. 36) Chambers said "Schwabe was disposed to find a connection between sunspots and meteoric showers. There is something of a coincidence between these sunspot periods and one shower period, but it is no doubt accidental." But is it accidental? Apparently not if other facts are investigated, such as the dates of occurrence of the nine principle meteor showers, two of whose centers are just 6 months apart, near the time the earth is close to the longitude of the sun's axis, and three of which are near the middle of a month.



● Fig 4: Cycles of 1/12 year in sunspot numbers and rainfall, having major peak about the 12th of each month.

The significance of these dates is partly indicated by a contribution by the writer to the Bulletin of the American Meteorological Society, October 1954, under the title Evidence of a Precipitation Cycle of One Month. Fig. 4 shows two graphs of those two monthly cycles, having their main peaks about the 12th of the average month. The sunspot graph was derived from the writer's table of mean sunspot numbers for every calendar day for 50 years, which table was reproduced in the December 1954 issue of ROADS AND STREETS.

More than a century ago Sir John Herschel asked four astronomical questions that he made no attempt to answer:

"*Why*, we are tempted to ask, do the diurnal rotations of Mercury, the Earth, and Mars agree to an hour? *Why* are the densities of the Sun, Jupiter, Uranus and Neptune exactly alike, and just one fourth of the Earth's? Again, among the satellites, *Why* are the periodic times of Saturn's third and fourth satellites respectively, precisely double those of the first and second? And *Why* are rotations of the satellites, generally, on their axis performed in precisely the same times as their revolutions about their respective primaries? — Essays, p. 297-298.

As to the last question he cited an attempted answer by an astronomer with whom he did not agree.

As to that last question the electromagnetic theory here presented may give the answer. The magnetic poles of a rotating satellite would induce electric currents in its primary. Since this would constantly consume some of the satellites rotating energy, it would evenually cease to rotate with respect to its primary. Moreover when thus finally at rest, its magnetic poles would be in the central meridian. This appears to be the case as to our Moon. The great crater, Tycho, close to the central meridian, qualifies as the south magnetic pole of the Moon.

Table 2 — Rainfall Cycles Due to Heliocentric Conjunction of Giant Planets

	Cycle Years	*Conjunction, A.D.*
Jupiter — Saturn	19.859	1941.5
Jupiter — Uranus	13.808	1955.08
Jupiter — Neptune	12.789	1945.6
Jupiter — Alpha	12.074	1954.2
Saturn — Uranus	45.368	1942.6
Saturn — Neptune	35.871	1953.13
Saturn — Alpha	30.808	1944.3
Uranus — Neptune	171.33	1822.8
Uranus — Alpha	96.00	1946.5
Neptune — Alpha	218.35	1884.8

FOOTNOTE: Cycles in thickness of treerings often have maxima at opposition as well as conjunction of these giant planets. Alpha is an inferred giant planet of 672-year orbital period. The dates of its conjunctions are approximate, for its orbital eccentricity is not known; but they agree well by big treering analysis with the dates here given.

Each of Herschel's other three questions is now known to be erronious as to some statement of alleged fact; e.g. Mercury's rotary period which is not known. The densities of the sun and the three cited planets are only approximately similar; and the orbital periods of the paired satellites are not precisely commensurable as they were supposed to be in Herschel's day. Nevertheless, each of the three questions remains important, for close approximations to commensurability are strongly indicative of a cause.

If the Sun, Jupiter, Uranus and Neptune have cores of about the density of the Earth which is 5.5, and if each is encased in an ionosphere having 1.5 times the core's diameter, the overall density would be about 0.3 that of the Earth. In the case of Saturn, if the ionosphere's diameter is double that of the core, the overall density of Saturn would be about ⅛ that of Earth or about 0.7, which it is. Every student of astronomy knows that the sun is believed to be gaseous throughout. Yet the 11.2-year sunspot cycle is best explained if the sun has a magnetic molten core that rotates in 22.4 years. Then when each of two magnetic poles is in heliocentric longitude 290 degrees, a sunspot peak of the 11.2-year cycle occurs.

As to Herschel's third question, close approximations to commensurability of orbital periods exists throughout the solar system, as shown in Table 1. These approximations to commensurability indicate that originally all these orbital periods were exactly commensurable If so, they probably were harmonic, for Earth and Uranus have an orbital ratio so nearly 1 to 84 that it is very likely that it is exactly 1 to 84, and that the estimated period of Uranus is slightly (4.8 days) in error because of the gravitative effect of one or more Trans-Plutonic planets, e.g. Alpha. The writer, by using varves, has found good geological evidence of at least three more planets that are harmonic with Alpha, and have orbital periods that are 9, 27, and 81 times Alpha's period of 672 years (Fig. 5) which is just 8 times that of Uranus. These harmonic planets may be designated by the Greek letters Alpha (672 years), Beta (2016), Gamma (6048) and Delta (18,144), All four had a wet, cold peak 2374 B. C.

The Deluge recorded in the Bible was dated 2348 B. C. by James Usher, a celebrated student of Biblical chronology, but his reliability is questioned by those who favor the previously accepted 2501 B. C. That the wettest period in historical times occurred about then is indicated by several facts, notably: (1) The greatest thicknesses of varves in the bed of Lake Saki, Crimea; (2) the highest flood levels of the Nile scribed on its rock walls in Dynasty XII, and (3) the date of the last overflow of landlocked Owens Lake in California. This last event was dated as about 2300 B. C. by H. S. Gale (U. S. Geol. Surv. Bull. 580-L). Analyses of Owens River in 1914 showed it would have taken 4200 years to supply the chlorine in Owens Lake after it ceased overflowing. There were two Pyramid Building Ages in Egypt at times of greatest prosperity, the second being in Dynasties XI, XII and XIII, with its center near the wet peak of Delta's cycle, 2374 B. C. The first Pyramid Age was begun about 3900 B. C., according to Prof. K. R. Lepsius. But Sir Joseph Norman Lockyer found that pyramids of that Age were built 4200 B. C. The Egyptians then were sunworshippers, so he inferred that they oriented the pyramids so as to face the rising sun on the longest day of the year. Since the earth's axis gyrates a full circle in about 26,000 years, the pyramids no longer face the sun. By a field survey of the pyramids he was able to calculate the lapse of time since their building and thus found that they were built about 4200 B. C. This is 1826 years prior to 2374 B. C., or only about 200 years less than Beta's cycle of 2016 years. Hence it is highly probable that the first Pyramid Age occurred in the long wet phase of a Beta cycle, for it is harmonic with the Delta cycle.

By using the same Egyptian pyramid method, Lockyer dated the ancient English monument called Stonehenge, and made it 1680 B.C. The Beta cycle of 2016 years had a rain peak 2016 years after 2374 B.C. or 358 B.C. about when reindeers inhabited Germany. Two of Alpha's 672-year cycles preceding that date gives a wet, cold peak 1702 B.C. or only 22 years prior to Lockyer's date of Stonehenge.

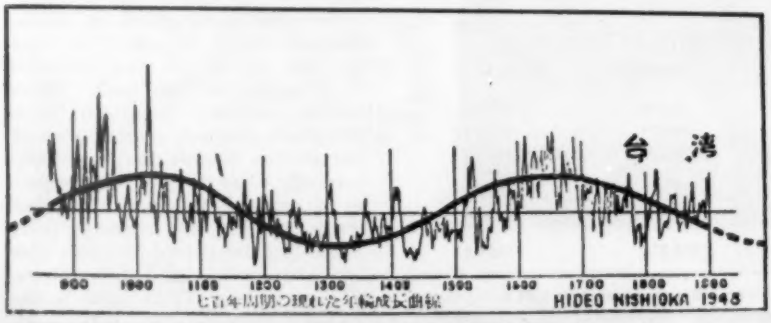
Dry, warm maxima of the Alpha, Beta and Gamma cycles were simultaneously due to 650 B.C. That was about the center of the Dark Ages, and about when Walker Lake, Nevada, went dry as shown by the time required for the Walker River to deliver its present volume of chlorine to the lake.

Delta has recorded 20 cycle peaks in marine beaches in Catalina Island, California, the highest being about 1700 feet above the sea. See the November article of this series.

J. M. Weller, in his Cyclic Sedimentation of the Pennsylvania Period (Jl. of Geol., Feb-Mar., 1930) found 42 coal beds about 23 feet center to center. The present writer measured rock varves in that region averaging some 250 to the foot, which shows this coal cycle to be Beta's cycle.

At least 14 researchers have reported finding a cycle of nearly 8 years in sunspot numbers, weather, tree-rings, varves and prices of wheat. W. H. Beveridge, who found a cycle of 8.05 years in European wheat over a 300-year period, also found one of 24.0 years. Since the ratio of these cycles is 3 to 1, it seemed to the writer that they might be subcycles caused by Alpha and Beta whose ratio is 3 to 1. If so their peak years should coincide with those of Alpha and Beta. This was found to be the case. Then analyses of thicknesses of Lake Saki varves were made to ascertain whether cycles of 72 and 216 years could be found and their peak dates correlated with those due to Gamma and Delta. This was also found to be the case.

How could those harmonic planets produce these subcycles whose lengths are 1/84 of the lengths of their orbital periods? It might be that their periods of axial rotation would cause those subcycles; for rotation of a magnetic core of the sun in 22.4 years gives the best explanation of the 11.2-year sunspot cycle, as well as Hale's 22.4 year magnetic cycle. If so, since earth's orbital period of one year is commensurable with the 8-year cycle, the earth itself may partly owe its



● Fig. 5: Graph of Formosa treering thickness by decades recording a 672-year rainfall cycle due to the inferred planet Alpha.

DIGEST of Current Engineering Literature

By JOHN C. BLACK, Associate Editor

Electronic calculation of traverses

Three considerations lead the California Division of Highways early this year to develop machine calculation of its survey traverses — economy, speed (elimination of a "most persistent bottleneck"), and the release of manpower for other engineering service. Though it was recognized that complete automation would be possible on the complex and expensive electronic machines now available, the immediate need of the California engineers was an approach to automation through the use of equipment already available in the Division's main office, where tabulation and solution of many problems had been done electronically for nearly twenty years.

Key to the calculation of traverses was found in a procedure developed by the International Business Machines Corporation for obtaining the sine and cosine of a bearing accurate to seven decimal places. Reduction of bearings to radians is a necessary step, but the machine does it. Formulas are given in this article and a case example presented.

Traverse data are sent to Division headquarters at Sacramento from the eleven district offices, and computations are generally returned the same day. Air mail is used where practical.

Eight types of traverse problems cover the great majority of cases, and work from the various districts is assembled and processed by groups accordingly. The computing machine is a modified IBM Electronic Calculator, Type 604. Other required items are key punches, verifiers, collators, sorters, tabulators, and reproducing punches.

"In general, no inspection or check of the finished tabulation is made before mailing. The users of this service have found that a detailed check of the computations is not necessary. A check of the traverse sheet before submitting it for computation, together with an inspection of the error of closure, end coordinates, and closure to end coordinates on the completed tabulation will in general show up any significant error."

The cost of traverse calculation as performed manually has been estimated at 13 cents a course, exclusive of checking; when processed through the presently available IBM equipment the cost is approximately 5 cents. The machine calculation cost includes a pro rata charge for machine time.

With the development of these methods of traverse calculation completed, the authors are turning their attention to problems of earthwork, traverse adjustment, and other types of routine calculations.

"Automation — Machine Computations Save Engineering Time" by Sam Osofsky, Supervising Highway Statistician, and R. K. Breece, Assistant Engineer of Design, CALIFORNIA HIGHWAYS AND PUBLIC WORKS, *P. O. Box 1499, Sacramento, Calif., July-August, 1955.*

A British view of prestressed pavement

Several prestressed roads have been built in this country (England) and abroad. The paper comprises a review of the present situation regarding this method of construction. Causes of failure in plain and reinforced concrete roads are considered and the significance of prestressing is assessed in the light of them. Particular attention is paid to the formation and development of cracks.

A distinction is made between two types of prestressed road — the individual-slab type and the continuous type.

The first type, which includes all prestressed roads laid in this country, consists of separate slabs with expansion joints between them. These slabs have been of lengths from 61 to 404 feet. They have usually been prestressed by internal cables, and various cable layouts have been used. Some difficulty has been experienced in forming the ducts in which the cables run. If there is excessive friction or binding between the cable and the side of the duct, it becomes impossible to extend the cables fully, and the full value of prestress is not obtained. The best solution seems to be to use metal sheathing. With straight cables, the effect of the cable on the slab is similar to that of an externally applied load, and some research work has been done on the resultant stress distribution at the ends of the slab.

The second type of prestressed road consists of a continuous slab, without expansion joints, prestressed by jacks which generate a thrust along the slab. At the ends of the slab, the thrust is resisted by abutments. After prestressing, the jacks are locked or concrete wedges inserted to hold the strain so that, in consequence, the prestress will vary with temperature and moisture conditions. Stability against buckling during periods of high stress seems to be practicable, but the question of the loss of the minimum residual prestress due to creep in the concrete has still to be settled.

The effect of sub-grade friction is to resist the changes in slab length which are caused by temperature and moisture changes. Stresses of restraint are induced in the slab and may cause very serious loss of the prestress. It is desirable to have a low value of sub-grade friction, and research work to this end is in progress. The results of some investigations which have been carried out suggest that, even where a sliding layer of sand is used, sub-grade friction may have a coefficient of between 1.5 and 2.

"Prestressed Concrete Roads" by J. P. Stott, ROADS AND ROAD CONSTRUCTION *(England), April, 1955.* HIGHWAY RESEARCH ABSTRACTS, *2101 Consitution Ave., Washington 25, D. C., September, 1955.*

(Continued from opposite page)

existance to Alpha, Beta, et al of that triplex series of planets.

As shown in Table 1, Mercury's orbital period differs only 4% from being exactly ¼ of the Earth's period. What is much more significant is that the periods of all 9 of the known planets are so nearly commensurable as to indicate that originally they were harmonic.

The next article of this series will discuss the cause of orbital revolution of planets and satellites which the writer regards as another exemplification of the Faraday principle that explains their axial rotation.

This is an electromagnetic universe, as might have been surmised when, more than 80 years ago, James Clerk Maxwell discovered that light and all other radiant waves are electric and magnetic phenomena, capable of exerting pressure.

What's New
in Equipment and Materials

Reader Service Coupon on Page 16

Five New Truck Cranes

Five new truck-crane models, ranging from 12½ to 35-ton lifting capacity, are now being offered by Link-Belt Speeder Corporation, Cedar Rapids, Iowa. They are called Zephyrcranes because of their speed in moving from job to job. All of the new models feature Speed-o-Matic — the true power hydraulic control — which permits the operator to control all working operations with a "flick of the wrist." This feature alone, by reducing operator fatigue, is said to increase output up to 25 per cent or more.

In addition to Speed-o-Matic, the Zephyrcranes are said to deliver ample net horsepower or actual line pull for all operations. The manufacturer claims that this greater "net" horsepower plus more live weight allows the machines to handle more work in less time with lower overall cost for maintenance and service.

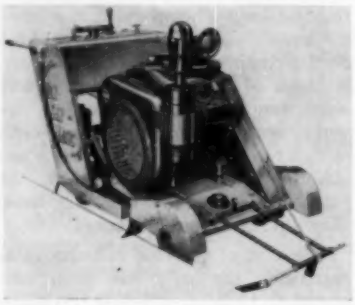
One of Five New Truck Cranes of Link-Belt Speeder

All of the new models have power hydraulic operated clutches that are self-compensating for heat and normal lining wear. They are fully convertible to standard front end attachments, and are available with torque converter power units. All are mounted on specially designed carriers with full-floating walking beam rear axle supports that allow travel over uneven terrain. Also available are screw-type outrigger jacks and pontoons, and removable rear outriggers. Another important feature, available on all models as an extra, are Speed-o-Matic reversing clutches for either or both main drums. This feature permits power controlled load lowering of main hoist line and jib whip line.

For more information circle 106 on Service Coupon Page 16 and mail now.

36 H. P. Concrete Saw Has "Retract-A-Turn"

An all new self-propelled concrete saw, Model-360, introduced by Clipper Manufacturing Co., 2800 Warwick, Kansas City 8, Mo., combines 36 h.p. with "Retract-A-Turn" automatic retractable turning wheels, patent pending. The new "Retract-A-Turn" is stated to feature cut line-up time in half, completely eliminating lifting, breaking back or tilting forward when moving into sawing position.



Clipper Model C-360 Concrete Saw

"Retract-A-Turn" operation is effortless and automatic. Dual caster wheels automatically take over the load whenever blade is raised out of the cut. Lower the blade into the cut, and the caster wheels are raised clear of the pavement. For straight-line cutting the saw moves forward on four solid rubber-tired wheels, straight and true in the cut without drifting to either side.

Automatic control of the new "Retract-A-Turn" wheels is accomplished through Clipper's "Positive Screw Feed" that lowers and raises the blade in and out of the cut without bumping or scraping. Screw Feed, a "must" when using the new "GreenCon" abrasive blades in green concrete, allows instant and easy compensation right from the dashboard for the diminishing diameters of abrasive blades, and provides the positive method for maintaining constant depth of cut. The greatly increased speed provided by the new 36 horsepower Model C-360 Clipper enables it to operate at speeds up to 26 ft. per minute.

Clipper's exclusive pivoted cutting head permits controlled front-end weight distribution and allows sufficient load over the blade to prevent its riding up and out of the cut, insuring constant depth of cut, reducing vibration and prolonging blade life.

For more information circle 107 on Service Coupon Page 16 and mail now.

Wheel Tractor

A new rubber-tired 42 h.p. wheel tractor, the International 300 Utility Model, designed for the industrial field, has been announced by International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill.

Powered by an IH C-169 gasoline engine, the tractor weighs 3,820 lb. — 1,000 lb. more than tractors of comparable size and class. The added weight provides greater traction, stronger power train and axles, according to International engineers.

The Model 300 is available either in a standard 5-speed transmission or Torque Amplifier drive. The field-proved economical Torque Amplifier gives 10-speeds forward from 1.5 to 16.7 mph and gives the advantages of speed and power changes up to 45% on the go without operator touching throttle, clutch, or shifting gears. With the Torque Amplifier continuous power is supplied to drive wheels even when changing tractor speeds.

Specifications of the new model 300 tractor include: Wheelbase — 75 in.; Overall length — 118 in.; Overall width — 59½ in.; Clearance, rear axle — 19½ in.; front axle — 20½ in.; Turning radius — 9 ft. 8 in.

The new member of the International family is available with a power take-off, completely independent or transmission driven, and a Hydra-touch equipment control permitting front and rear-mounted attachments to be controlled simultaneously or individually.

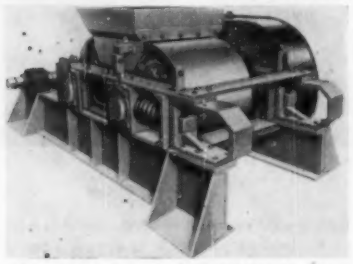
Over 23 attachments applicable to the industrial field are available as optional equipment for the Model 300.

For more information circle 108 on Service Coupon Page 16 and mail now.

Model 300 with ½-yd. Front-End Shovel and Backhoe

Twin Roll Crushers

A new size of twin roll crusher which is stated to increase production 33⅓ per cent over its smaller counterpart without a corresponding hike in cost is now being made by Pioneer Engineering Works, Inc., 1515 Central Ave., Minneapolis, Minn., subsidiary of Poor & Co., Chicago.



New Size Pioneer Twin Roll Crusher

Changing the roll setting to vary the size of the crushed product will also be a simpler job through a modification of design which incorporates a hydraulic jack and shim adjustment mechanism.

The new crusher has rolls 30 in. in diameter and 24 in. in width and will have a production rate a third again as much as the next smaller size, the 30x18 unit; the large capacity increase being effected at a relatively low increase in overall size and initial cost.

Capacity of the 30x24 crusher runs up to 254 tons of —2¼ in. aggregate per hour, based on material weighing 2,700 lb. per cubic yard. Maximum feed size is 4½x4½ in., when using low corrugated rolls. Overall dimensions of the new unit are 8 ft. 6 in. long x 6 ft. 10 in. wide, 53⅛ in. high; weight is 11,200 lb.; power requirements are in the 85-105 hp range.

For more information circle 109 on Service Coupon this page and mail now.

Tractor Shovel Has 165 HP Engine

Introduction of a turbocharged diesel engine rated at 165 hp for the Michigan Model 175A tractor shovel has been announced by the Construction Machinery Division, Clark Equipment Co., Benton Harbor, Mich.

The Model 175A, with 2¼ cu. yd. bucket capacity and weighing 24,100 lb., has four-wheel drive and rear-wheel steering. It features the Clark-engineered and built power train, with a torque converter, power shift transmission and planetary-wheel drive axles. The three-to-one torque multiplication provided by the converter makes available an increasing flow of power when needed and elimination of the clutch is stated to remove the chief cause of both operator fatigue and maintenance problems. The Model 175A has four forward and reverse speeds, with a maximum of 27 miles per hour.

Michigan Model 175A Tractor Shovel

For more information circle 110 on Service Coupon this page and mail now.

Secondary Spring Suspension For Screens

An optional secondary spring suspension designed to eliminate transfer of vibration, to increase freedom of screen motion and to reduce strain on moving and structural parts, has been developed for its larger screens by Pioneer Engineering Works, Inc., Minneapolis 13, Minn., subsidiary of Poor & Company, Chicago.

Consisting of four heavy coil springs, one in each corner of the main frame, the new type mounting floats the weight of the entire screen and frame, resulting in three benefits. Transfer of vibration to the supporting structure, bound to occur to some degree on large vibrators, is virtually eliminated; motion of the screen pan is less restricted than it would be by rigid mounting of the main frame to the supporting structure in an attempt to stop all transfer of motion; strain on both moving and structural parts is reduced, the moving parts having more freedom for motion and the support structure having greatly reduced and weakened motion to resist.

SWENSON SPREADERS FOR ICE CONTROL

SPREADS SALT 200 LBS. PER MILE OR IN ANY DESIRED AMOUNT

Lays a Narrow Strip or Full Traffic Lane

Handles all granular materials — salt, cinders, sand, calcium chloride, rock chips. Spreads at speeds up to 30 M.P.H. Clutch-controlled flow: steady or intermittent for hills and intersections.

Write for complete information

SWENSON SPREADER & MFG. CO.
LINDENWOOD, ILLINOIS

. . . for more details circle 230, page 16

Save gas, gears, tires.....

APPROVED Jeep EQUIPMENT

WARN *Automatic* HUBS MAKE 2 TRUCKS OUT OF 1

Road or no road, Warn *Automatics* give your 4-wheel drive sensational new economy, driving ease and mobility. Your 4 W. D. is automatically a "free-wheeling" 2-wheel drive, or 4-wheel drive AS YOU SHIFT! Use it as a town car, "pick-up" or work horse in and out of mud, sand; on and off the highway. It "free-wheels" or "4-wheels" to suit conditions AS YOU SHIFT! What's more, you can drive at *high speed* in 4-wheel drive on any terrain! Automatic (and Locking) models for *all* makes of 4 W. Ds. from ½ to 1½ tons. Ask your *authorized* factory truck dealer for a FREE DEMONSTRATION of amazing Warn Hubs, or write:

GET MAXIMUM USE FROM YOUR 4-WHEEL DRIVE!

WARN *Automatic* HUBS

WARN MANUFACTURING CO., Riverton Box 6064-RS12, Seattle 88, Wash.

. . . for more details circle 237, page 16

Another advantage in the new mounting is that the rear (receiving end) of the mounting framework has been designed to facilitate installation of conveyor supports.

For more information circle 111 on Service Coupon Page 16 and mail now.

30 Ton Hydraulic Shop Press

A new 30 ton hydraulic shop press, offered by Owatonna Tool Co., 435 North Cedar St., Owatonna, Minn., is claimed to do more jobs faster.

OTC 30 Ton Press

Unique are the horizontal bed channels which extend beyond the upright channels forming a valuable open throat work area greatly increasing the scope of the jobs the press can handle. The versatility of the unit is increased by window openings in the upright channels accommodating bars and long shafts for straightening or service work. An adjusting wheel at the top of the frame permits fast easy adjustments of the bed channels, and the adjustable cross head attachment affords full horizontal ram adjustment for off center jobs.

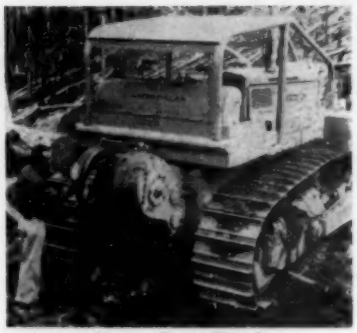
As with all OTC hydraulic equipment, the 30 ton power-twin ram and two speed pump are readily detachable for use with standard OTC pullers and accessories on other service jobs in the shop or field. Overall height is 72 in., width 55 in. and weight complete with ram and pump is 820 lbs.

For more information circle 112 on Service Coupon Page 16 and mail now.

Winch Develops 76,000 lb. Line Pull

A new towing winch of matched design for the new Caterpillar D9 crawler tractor, announced by Hyster Co., 2902 N. E. Clackamas St., Portland 8, Ore. develops a line pull of 76,000 lb.

The unit features a constant mesh transmission, flexible cable controls, built-in drawbar, cast alloy-steel drum, 15-in. brake, hardened gears throughout



Hyster D9A Winch

and brake compartment sump. An automatic brake is available as optional equipment. Net weight is about 3,250 lb. Barrel diameter of the drum is 16 in., flange diameter is 27 in. and barrel length 11 in. The cable capacity is 269 ft. of 1⅜ in. line or 217 ft. of 1¾-in. line.

The new Model D9A winch is available in two versions, one for the direct drive Caterpillar tractor, the other with alternative intermediate gear train to suit the D9 torque converter model.

For more information circle 113 on Service Coupon Page 16 and mail now.

For more equipment items, see page 124

BECAUSE they are Self-Ballasting. Frink V-Type Sno-Plows are suspended from the truck attachment by two Heel Adjusting Chains. The weight of snow on the moldboard ahead of this suspension point creates a downward pressure.

BECAUSE there is No Side Thrust. Snow is raised above the level of the adjoining snow on the inclined forward portion of the moldboard, thus eliminating side thrust caused by the snow packing into this adjoining snow.

BECAUSE they Push Easier. The cutting edge and the front of the moldboard have sufficient shear to keep the snow moving. Also, the Riser board raises the snow before carrying it to the sides, thus requiring less pushing power.

BECAUSE they Bevel Side Banks. Frink V-Type Sno-Plows are wider at the tips than at the cutting edges. This bevels the side banks which discourages drifting and prevents snow from falling back into the road.

For further information on this Sno-Plow write for catalog to Clayton, N. Y., Box RS5512

FRINK SNO-PLOWS

FRINK SNO-PLOWS, INC., CLAYTON, NEW YORK

Made in Canada by

FRINK SNO-PLOWS of CANADA, LTD., TORONTO, ONT.

. . . for more details circle 199, page 16

Bituminous ROADS AND STREETS

Repairs with cold pre-mix in progress on U.S. 77 near Eldorado, Kansas. Gladhill blade towed by Case tractor; state maintenance crew spreading mix following tack coat application over patch areas.

Published by Gillette Publishing Company
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New Automatic Plant for Wichita Contractor
What's New in Road Equipment and Materials

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These outstanding Tarmac features make it ideal for almost any type of road: secondary highways, feeder roads, rural roads, city boulevards, bridge surfaces—and for parking lots and airport runways. Write for further information today.

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KOPPERS Tarmac® MAKES BETTER ROADS

. . for more details circle 213, page 16

VIEWS AND COMMENTS

By H. G. Nevitt

Now Is The Time

WE DOUBT if anyone anticipates the grand highway program visualized by President Eisenhower will fail to materialize in some form or other in the relatively near future. The need is so obvious, the public demand so overwhelming, that some plan seems surely forthcoming. Meanwhile we are having an appreciable speed-up in our highway construction due to increased Federal aid and other factors. Probably it is just as well that the big program is still a little ahead of us, because there are many things that need to be done in the meantime.

We have the facilities needed for this tremendous expansion in our highway building, but it will nevertheless offer many problems. The supply of competent engineers is already well below the demand, further steps to compensate for this will be required. When the indicated volume of construction gets under way, every experienced worker in the highway field will be needed for the immediate daily demands. Certainly there will be no time or personnel available for bringing specifications up to date and otherwise getting our planning, controls and similar organized for this increased output; obviously such things should be done now to the extent possible.

Are there any such steps that should and can be taken at this time? We believe so. Many phases of highway technology have advanced rapidly in recent years; the material requirements, methods specified, and other factors in the actual construction should be made to reflect this. Unfortunately, such action has not been taken to the extent possible. Under normal conditions minor disagreements, conflicting points of view, and similar slow up modernization of specifications, but are ironed out in due course; perhaps the job is better done as a result. But this will hardly be possible once we are swamped with the realities of a large construction program. What we need today is a determined effort to correct agreed deficiencies in existing specifications or methods so that our procedures will be brought up to date, preferably on a national standard basis.

As an example of this situation we can point to the matter of asphalt specifications, on which we feel in the best position to speak. These are almost exactly the specifications that were agreed to in 1933. There have been some minor improvements, such as taking care of the ductility testing of higher penetration asphalts or distillation residues and similar. But the basic lacks of the 1933 compromises are still with us. The word compromise to a considerable extent describes them; the situation had become so intolerable that standard specifications with many faults were preferable to the confusion that existed. These deficiencies are appreciable. Meanwhile we have had over 20 years of advancing knowledge in asphalt technology. Even though we may not be able to get ideal asphalt specifications (especially from the standpoint of defining quality), unquestionably we can improve the ones now in existence.

Control of Curing Time

We need better control of curing time, so that the specifications assure known and constant curing rates. We need to eliminate the deplorable situation that cutbacks meeting the same specification from two sources may act entirely different in use. We need to eliminate the temperature factor in controlling cutback viscosities. All these are matters which can certainly be improved by a little attention, even though there is concern over even more fundamental and serious points which probably must await further technical advances before agreement can be obtained as to what to do.

In brief, asphalt specifications can be helpfully brought up to date where there is practically no disagreement as to the technical situation even though there are conflicting points of view (primarily due to the desire to protect an established manufacturing situation, or similar) on the best cure.

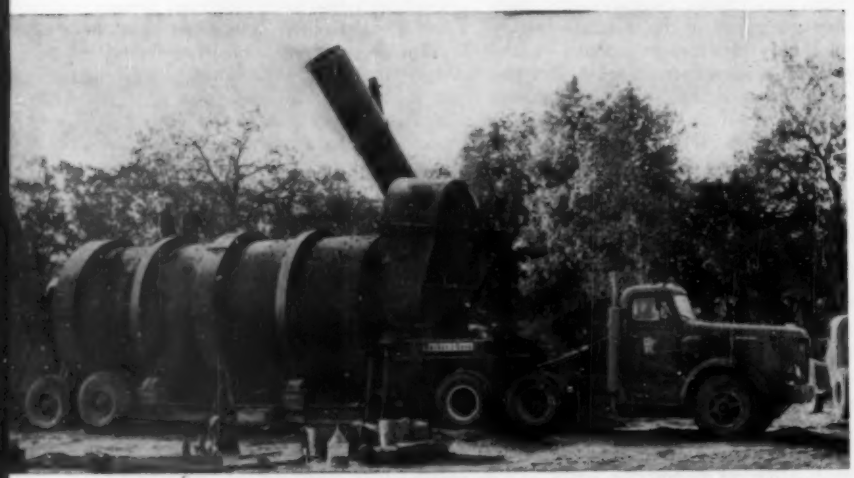
Numerous other examples could be cited. Admittedly the rapid advance of highway technology offers problems at times. There is a natural reluctance to replace an old requirement, no matter how obsolete, with a new one when current discoveries indicate this revised standard will in turn need correction or replacement in a few years, perhaps sooner. Yet the alternative is the retention of outmoded specifications indefinitely. And this situation may at times become almost ridiculous as the technical pace quickens. In brief, this situation should not justify failure to progress and incorporate into standardized, widely acceptable specifications the things that we definitely do now know.

As a matter of fact this is happening on a local basis. More and more are the highway specifications of individual agencies varying due to conviction in each case that the change must be made even if nationwide uniformity is sacrificed in doing so. The asphalt specification situation discussed above is a good example of this; we are likely to have as much confusion as we encountered in the start of the low cost bituminous road development if steps are not taken. Busy though everyone is today, the pressure will be far greater tomorrow. Now is the time to take steps to ease the strain and prepare for the job ahead. Surely every engineer welcomes this enlarged program because of the opportunities that come with it. But we certainly cannot likewise avoid the attendant responsibilities and the need to prepare for them. Every phase of highway endeavor should be making preparations, standardizing, getting organized to do not merely an outstanding job from the standpoint of spending money and building roads, but likewise of providing the quality of engineering that such a program not merely merits but the public interest demands.

Everything on

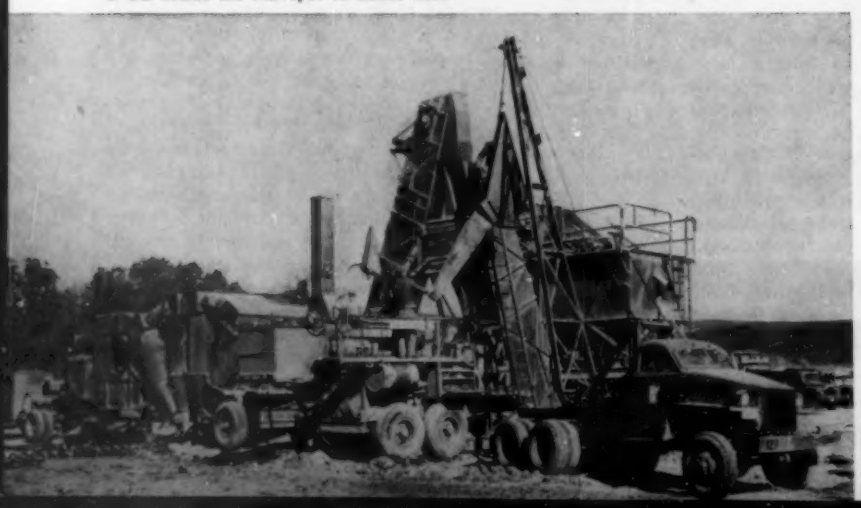
An example of the methods and equipment — and some of the delay problems — of a corn-belt contractor who has taken advantage of today's highly portable equipment to complete more jobs per season.

● Winch operated gin-pole mounted on 4 x 4 truck completes dismantling of dryer.



● Dryer dismantled (stack being taken off by crane on rear side). International truck-tractor coupled up ready to go.

● Off comes the conveyor to mixer box.



BY THE time the photographs shown here were developed, the asphalt plant being taken down was far away. The plant is that of W. Hodgman and Sons, of Fairmont, Minnesota. The move being made on completion of a road job at Sabula, Iowa, explains why Leonard A. "Speed" Quiram, plant superintendent, didn't come by his nickname by accident.

Superintendent Quiram, although never seeming to be in a hurry, engineers a remarkably fast and smooth plant move between jobs, capitalizing the effort which equipment manufacturers have made to give him just such mobility for greater seasonal production. Plant moves as well as routine production are managed without the necessity for "Speed" to raise his voice, reflecting the excellence with which he has picked and trained his crew. The operators and mechanics know what he wants, and know their jobs. A move-out and relocation usually takes only three days or so.

The company purchased this plant early in 1954. Not content with waiting for delivery of the equipment, the firm dispatched trucks and trailers to the Barber-Greene factory and hauled the entire plant and a new finisher back to Minnesota, a distance of 450 miles. The 200-ton-per-hour plant was set up July 14, and began operation at Currie, Minnesota. During the remaining four months of the season the plant produced mix for six jobs, with moves to five scattered locations. Here tabulated is the very satisfactory production story.

Wheels Ready to Roll

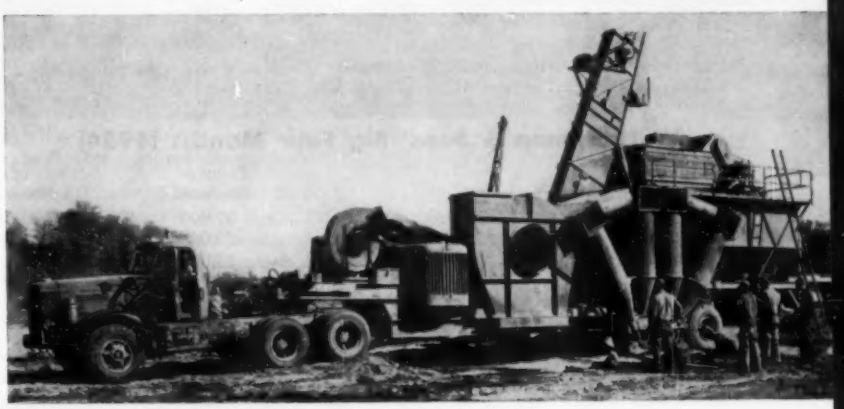
The 1953 season's output of 98,000 tons with this plant fell short of the previous year's, due to circumstances which are of interest to both the contracting fraternity and to highway departments anxious to get maximum results from their funds. When "Speed" arrived at Sabula, Iowa, in mid-September, he set up his plant on what was originally scheduled to be a fast run for completing a job of laying 24,000 tons of dense graded plant mix.

The company which was accustomed to placing a 2-in.-thick mat in Minnesota, found the 1½-in. mat in Iowa would require lowering the output of the plant to 180 to 185 tons per hour. This required extending the job schedule several days.

Next came a prolonged rainy spell causing ten idle days by the end of September. This was followed by still more intermittent rain and wet conditions or days when the temperature fell below 40° F. during paving hours. On October 22, when the plant was finally knocked down for the winter, the firm had lost nearly four weeks compared with the good job conditions usually prevailing this time of year.

A third although minor cause of delay was the failure of an old 7½ kw generator, which lost the company a day's run. The events of September and October are recounted here to illustrate the fact that, even with today's highly perfected portable equipment, the contractor has to plan for contingencies and hope to even out his luck from job to job and year to year, figuring his bids accordingly.

● Maximum use was made of equipment. Hough Payloader bucket used here to ease down a conveyor tower.



● International tractor coupled up to 16-cyclone dust collector.

● General view of the asphalt plant during production.

● Almost through. All that remains to be done is lower the gradation control unit on to its wheels and couple up.

● Cleaver-Brooks Model 1201 heater, mounted on wheels with trailer hitch, parked midway between fuel oil and AC tank, heats both.

W. Hodgman & Sons' Big Four Months (1954)

Minnesota Project	*Tonnage Produced*	*Hours of Operation*
State Route 47	17,000	86.5
State Route 47	20,000	101.25
12 mi. country roads	13,000	50.25
State Route 91	18,000	96.5
6 mi. country roads	6,200	32.75
State Route 4	31,000	162.25
State Route 47	6,115	25.75
Totals	111,315	555.75

With this highlighting of Hodgman's past two seasons, let us note the company's principal equipment used on the Sabula job, and the nature of the job itself.

As described by George McPherson, former bituminous engineer with the Minnesota Department of Highways, and now associated with Hodgman, "there is nothing in this plant that is not practically ready to roll."

The asphalt plant equipment consisted of the following units, Barber-Greene, except where otherwise noted:

1 Model 815 feeder powered by a U. S. 220/440 volt variable speed motor.

1 Model 374 belt conveyor, 36 in. x 45 ft. motor driven.

1 Model 838 rotary-drum dryer, 20 ft. x 9 ft., 200-ton per hour with low-pressure fuel oil burner system.

2 Model 880 bucket conveyor towers, 18 ft. 3 in.

1 Model 886 gradation control unit.

1 Model 858 dust collector, utilizing 16 V-mounted, 27-in. diameter cyclone collectors with an approximate capacity of 40,000 cu. ft. of exhaust gas per minute.

1 Model 848 mixer powered by an International Harvester UD-24 engine.

An International UD-24 engine powered the dryer and dust collector.

Power for lighting and motors, originally furnished by the above mentioned old generator, was supplied by a new Caterpillar 13.5 kw 220/440 volt electrical set powered by a D375.

Other equipment on the Sabula job included:

1 Barber-Greene finisher.

1 Allis-Chalmers HD-5 tractor with Tracto 1-yd. loader and TractoRooter.

1 Pioneer 24 in. x 30 ft. engine-driven belt conveyor for loading fine aggregate.

1 Link-Belt Speeder dragline with Johnson 1-yd. Clamshell bucket for loading coarse aggregate.

1 Cleaver-Brooks Model 1201 temperature oil booster, rubber-tire mounted, used for heating both AC tank and No. 5 Fuel oil tank.

2 10,000-gal. steel storage tanks with heater coils, one for AC, one for No. 5 fuel oil.

1 Buffalo-Springfield 12-ton tandem roller.

1 Huber 12-ton tandem roller.

6 International Harvester R-170 trucks equipped with Anthony 7-yd. Teleramic dump bodies.

1 Grace power-operated towed sweeper.

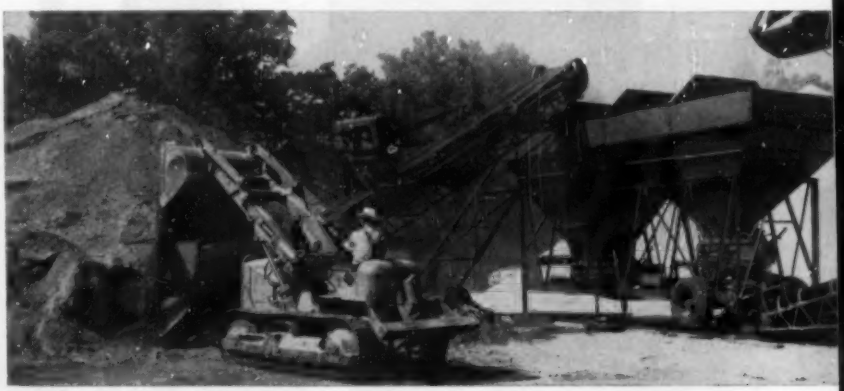
● Iowa state highway portable laboratory installed in old school bus.

● A Cedarapids 2236 single jaw primary crusher and a Cedarapids Model 4033 Hammermill secondary crusher provided 105,000 tons of stone for project.

20-ton truck scales manufactured by Thurman Machine Co.

Not only are the plant elements (except the scales) mounted on wheels, but all are equipped with trailer hitches, to permit easy handling and movement. A reliable witness states that he has seen "Speed" removing the belt from the conveyor drive on the feeder unit, while the mixer box was still filling trucks for the last of the paving.

Once the outfit is on rubber it travels at 35 miles per hour. On the road the unit resembles the movement of a "one-night-stand" circus.



● Allis-Chalmers HD-5 tractor with Tracto 1-yd. loader delivered fine sand to Pioneer conveyor serving feeder.

Dense Graded Job

The contract called for improvement and paving of U. S. 52 between Sabula and Bellevue, Ia., plus plant mix on an additional mile of highway. Paving consisted of dense graded plant mix placed in two 1½ in. courses. The existing road was a stabilized gravel road of the type used throughout Iowa for farm section roads. Prior to placing the asphalt, a 6-in. sand cushion was placed, followed by a 6-in. course of ¾-in. crushed limestone with seal.

● Secondary crusher delivered ¾ in. and ⅜ in. aggregate to separate 5-ton surge bins. Bin conveyor belts are push-button controlled.

The gradation specification for dense graded hot laid plant mix follows for this project.

Sieve Size	*Percent Passing* *Min.*	*Max.*
1 in.	100	
¾ in.	98	100
½ in.		100
2/5 in.	67	87
No. 4	47	68
No. 8	37	55
No. 30	19	34
No. 50	13	26
No. 100	6	
No. 200	3	10

Not less than 60% of the minus No. 200 was required to be pulverized limestone.

Iowa highway department specifications require that a representative calibrate the plant and verify the job mix formula at the plant site. Previously the theoretical job mix formula had been approved at Ames. An old school bus rigged up as a laboratory was stationed at the plant site. Moisture content, gradation of aggregates and abrasion test were per-

LOAD

Tractor mounted. New claw-action feeder with automatic release. Ten-foot discharge height. Eight-foot boom overhang. Self-propelled at 10 m.p.h.

LOAD economically with the new Barber-Greene 550 Windrow Loader.

LOAD rapidly up to 4 cu. yds. per min. of earth, sand, loam or similar material, even leaves, or load snow up to 7 cu. yds. per min.

LOAD continuously at capacities that keep ahead of all trucks normally available.

LOAD easily with fast maneuverability. Turning radius: only 8'6". Simple to turn around in a limited area.

LOAD like this: . . . 158 4½-yard trucks loaded with sand, loam and gravel in a 6-hour day . . . or 200 4-yard trucks loaded with moist sand and clay bladed from street surface in 9 hours! Here's real on-the-job loading efficiency.

Let us show you how a Barber-Greene Windrow Loader can cut costs for you

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Barber-Greene

AURORA, ILLINOIS, U.S.A.

BG

CONVEYORS LOADERS DITCHERS ASPHALT PAVING EQUIPMENT

. . . for more details circle 182, page 16

formed on the site, as well as test on the asphalt cement and mix.

The actual job mix formula adopted follows:

¾ in. crushed limestone	35 %
⅜ in. crushed limestone	35 %
Concrete sand	22.5 %
Fine sand	7.5 %
85-100 penetration AC	6.25%

Since a combination of four aggregates was required to obtain the proper gradation, considerable time was required to calibrate the plant. Highway department engineers took samples of the aggregates from stockpiles at the plant, subjected them to gradation and moisture tests, and then took samples of the combined mix from the belt and chute of the feeder to determine the over-all gradation of the combined aggregates.

Concrete sand was purchased from a nearby commercial source. A sand pit meeting the requirements for the 6 in. sand cushion had been located near the project. This pit was also used to supply fine sand for the mix.

Supplementary Notes on Aggregate Production

To obtain coarse aggregate for the base course and mix, Hodgman contracted with Ft. Dodge Limestone Co., which found a quarry along the project meeting requirements.

A total of 105,000 tons of crushed stone was required for all purposes, including 17,000 tons of coarse aggregate for the dense graded mix. This aggregate was equally divided between ¾ in. and ⅜ in. limestone. Both gradations were produced simultaneously by a Cedarapids crushing rig.

The quarry operation was well planned and utilized a minimum of equipment. The overburden was carefully stripped and the quarry floor kept well cleaned. These precautions were necessary to eliminate an excess of fines in the aggregate.

After stripping, relatively heavy charges of 50% Red Cross and 50% Silica Gel, closely spaced, where used for producing primary stone. Fragmentation was fairly uniform, but stone which could not be handled by the shovel was pushed aside. No secondary breaking was attempted.

The crushing operation follows:

A Link-Belt Speeder LS-85, ¾-yd. shovel with a 1-yd. bucket was used to load the 36 in. x 8 ft. apron of a Cedarapids 2236 portable roller-bearing single jaw primary crusher, powered by a Caterpillar D318 engine. A 30 in. x 27 ft. belt Conveyor delivered the primary crushings to a Cedarapids 4033 Hammermill secondary unit, powered by a Caterpillar D318 engine driving an electric generator. In order to obtain the high rate of production it was necessary to supplement the output of this generator with a Caterpillar D8800 electric set powered by a D375 engine. All power for the hammermill was furnished by this unit (truck-mounted) as well as power for operation of the surge-bin conveyor belts.

The secondary unit was equipped with a 28 in. x 12 ft. horizontal double-deck vibrating screen; a 30 in. x 30 ft. channel frame plant feed conveyor; a 30 in. x 16 ft. under-crusher conveyor; a 30 in. x 21 ft. channel frame truck loading conveyor; a 24 in. x 20 ft. truck loading rock conveyor; a 30 in. reciprocating feeder; and a 75 in. x 22 in. elevating wheel return system. The screens and recirculating belts were set to provide for delivery of ¾ in. and smaller aggregate to a 5-ton surge bin, while recirculated aggregate was delivered by the second loading belt to another 5-ton surge bin. Use of the surge bins permitted almost continuous operation of the crushers, even when trucks were not immediately available for loading.

Trucks were loaded from the surge bins by self-contained 24 in. x 19 ft. motor-driven conveyor belts, push-button operated.

Although rated as a 100-ton per hour crusher, production of the ¾ in. material for the base course reached a maximum output of 2,800 tons for an 11-hour shift (254 tons per hour). Average production on the ¾ in. and ⅜ in. material was 1,600 tons per day. A Caterpillar D6 dozer worked on the pit floor and stockpiled material.

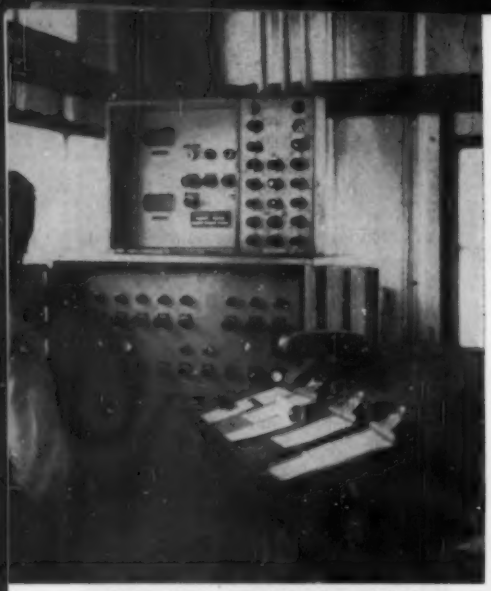
W. Hodgman and Sons have been engaged in road construction for over 20 years. With their asphalt paving subsidiary, Hazelmere Bituminous Co., they operate a total of three Barber-Greene hot-mix plants, and keep a Barber-Greene travel plant on stand-by. All of their equipment is kept in top condition and is serviced regularly. They have over 25 autos and trucks equipped with two way radiotelephone.

HALLER NEW VICE-PRESIDENT AMERICAN TRACTOR. Theodore A. Haller, formerly chief development engineer at the Allis-Chalmers, Springfield, Ill., crawler tractor plant, has been appointed vice-president and director of engineering of the American Tractor Corporation, Churbusco (Ft. Wayne), Ind.

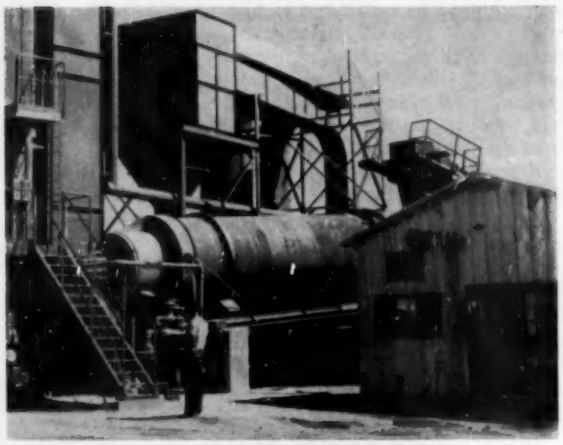
AMERICAN BITUMULS APPOINTMENTS. The American Bitumuls Asphalt Co., San Francisco, Calif., has announced the following appointments: Wayne Summers, formerly district manager, Perth Amboy District, has been appointed president of International Bitumen Emulsions Corporation, San Francisco, Calif. The principal area of operations is Canada, Hawaii, Alaska, Philippines and Central and South America. George E. Dewsnap, formerly district manager E. Providence district, has been appointed district manager Perth Amboy district. The two districts have been consolidated into one district.

● Extra protection for the public and motorist will be provided along the 18 miles of Garden State Parkway in New Jersey by fencing being constructed by Cyclone fence crew. The fence was built in populated areas along the Parkway north of Union, N. J.

New Automatic Plant for Wichita Contractor



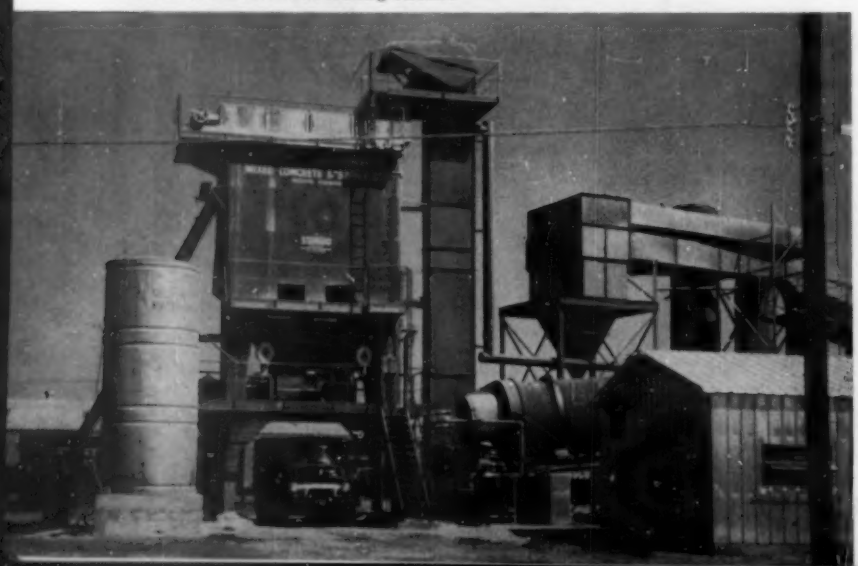
● Control panel with Hardy push-button system; operator watches plant through window.



● Showing dryer and dust collector of Ritchie plant.

● Schramm 105 shop-type compressor, which supplies air for gate and control operation.

● Ritchie Brothers' new plant — aluminum building which houses controls, compressor and electric motor, and serves as office, seen at right. Tank for cold mix materials at left of loading station.



WICHITA, fastest growing city in Kansas and scene of hundreds of blocks of new street construction, has several busy contractors. One is Ritchie Bros. Construction Co., which has outgrown its old asphalt plant and has supplemented production by adding a new plant in 1955.

Pictured here, this plant is a Standard assembly, built around a 6,000 lb. pugmill and capable of delivering 180 tons per hour of hot mix. Equipment includes a Standard 84″x28′ dryer; cyclone and multi-clone dust collector with 72 cones; wash tank; Barber-Greene 24″x270′ belt; reinforced concrete aggregate tunnel fed via Syntron feeders.

In line with the city's program of closer control of mix quality, the plant is equipped with Hardy automatic batch controls, Detecto scales and Syntron controller. The controls as well as a Schram 105 shop-type air compressor, driven by 20-hp electric motor are housed in a separate weather-tight building which also has an office room.

The firm of Ritchie Brothers (represented by brothers Proctor, Dean and Dave,) handles either cutbacks or asphalt cement grades through three storage tanks totaling 40,000 gal. capacity.

Anti-Stripping Agents—Pro and Con

By Malcolm L. Gordon

District Materials Engineer, Bureau of Public Roads, Cheyenne, Wyoming

A review of past research on additives and their present status as an aid in securing durable bituminous contraction.

ONE of the serious problems caused by water that has plagued us since the very beginning of bituminous construction is the problem of the loss of asphalt films from aggregate surfaces in the presence of moisture, more commonly called stripping. This phenomenon has long been a major source of failure in bituminous surfaces, the cause of which, in general terms, is the displacement by water of the bituminous film on the aggregate surface with resultant loss of adhesion between the individual aggregate particles and, therefore, the failure of the asphalt to function as a binder.

Such a stumbling block did not long go unchallenged, and as early as 1922 the problem was attacked from the physical angle by studies on the influence of adsorbed colloids on the surface of aggregate and investigations into the properties involved in preferential wetting, or coating, of aggregate. Since then much time and energy have been expended by public and private engineers alike in research activities to solve the stripping problem.

The results of this research have provided us a better understanding of the basic causes of stripping and were instrumental in the development by American Industry of the so-called anti-stripping agents which are now available. It is the purpose of this paper to touch upon certain conclusions that have been reached regarding the causes of stripping, test methods used and results obtained in the evaluation of the anti-stripping capabilities of commercial additives, and thereupon draw conclusions as to the effectiveness of such materials.

In the analysis of film stripping, one must consider first the three basic materials involved, i.e., water, bitumen, and aggregate. Relatively little research has been accomplished to evaluate the effect of the chemicals in natural waters on stripping with the exception that laboratory data have been developed indicating that the hydrogen ion concentration of water influences stripping to the extent that asphalt coating retention on an acidic stone is favored in a low pH solution whereas a high pH solution favors retention on basic stone.

The bitumen, likewise, has probably received less than its fair share of investigation, but what has been accomplished, coupled with actual performance in the field, has shown that asphalts from different sources, and different grades of asphalt from the same source, vary considerably in their resistance to stripping. In general, the higher the viscosity of the asphalt the better the adhesion, but the more difficult to coat, or wet, the aggregate initially.

Aggregate First Concern

The aggregate or solid portion of this system has, of course, been the primary target of the investigative effort. Two major approaches to the problem have been followed; (1) the mineralogical composition of the aggregate itself, and (2) the electrochemistry of the asphalt-aggregate interface.

Regarding the former, conclusive evidence points to the hydrophilic, or water preferential, aggregates as being the major offenders in detrimental stripping. Generally the siliceous rocks are hydrophilic and are acidic in character, as compared to the hydrophobic, or water-repelling, aggregates which are essentially basic. These latter include limestone, dolomites and the basic igneous rocks.

Having established this major difference in aggregates, the obvious assumption was made that if an aggregate which is hydrophilic could be treated to make it exhibit hydrophobic characteristics, its resistance to stripping when coated with asphalt would be greatly improved. Research to confirm this premise followed, and the bulk of the anti-stripping additives on the market today were subsequently developed to effect this change in the surface chemistry of the hydrophilic aggregates.

The electro-chemistry involved in the adhesion of asphalt films on the aggregate surface is, of course, closely connected with the surface chemistry of the aggregate. Early work in Germany emphasized the importance of the molecular structure of the asphalt binder in the understanding of film adhesion, in view of the existence in bitumens of polar groups which, due to polarity, become bound to the aggregate surface. This orientation was found to take place more easily in bitumens of low viscosity.

In 1940, experiments by Victor Nicholson indicated the adhesion of asphalt to aggregate could be improved by the amine compounds, which were termed cationic agents due to the positive charges carried by their molecules. The high polarity of these molecules made them more attractive than water molecules to the polar minerals which characterize most of the hydrophilic aggregates. In uniting, the polar ends of the molecules attached themselves firmly to the aggregate surface, and the nonpolar hydrocarbon end, being oriented outwardly, presents a hydrocarbon surface for the ready adhesion of the asphalt film. Essentially, this was the consumation of the desired change from a hydrophilic to a hydrophobic surface by the use of an additive.

From this time on, research activity centered along the line of cationic agents, and shortly thereafter commercial anti-stripping additives became available on the market for general use.

It is not within the scope of this

Presented at the 34th annual WASHO conference, Jackson Lake Lodge, September 9-10, 1955.

- Extensive data are now available to help the engineer determine the best use of anti-stripping additives
- Industrial asphalts vary considerably in their resistance to stripping, the higher viscosity grades usually showing best resistance.
- Siliceous rocks are generally the hydrophilic offenders; limestones, dolomites and basic igneous rocks are the water-repellent ones.
- Chief function of commercial additives is to charge the surface chemistry of hydrophilic aggregates. The additives are usually cationic agents which perform this correction by influencing polarity phenomena.
- The effectiveness of additives in securing better bond with wet aggregates has been well established by research, which is here reviewed.
- Stripping is a problem with some hot-mix construction. Heat resistent additives developed by the manufacturers have been found effective but their use has introduced problems of heat control and storage.
- Anti-stripping materials now developed give the engineer a widely effective tool in the solution of stripping problems.

article to discuss the chemical constituents of the many commercial additives, even if such data were available, but it is presumed that the majority of these additives have been developed on the cationic basis.

With the advent of the commercial additive, activity was then centered on investigation of these products to determine their effectiveness as truly anti-stripping agents, and additional information regarding them. Typical of such investigations was a study made by the Bureau of Public Roads and reported by Paul F. Critz and Joseph F. Goode in the July-August-September 1945 issue of *Public Roads*.

The objectives of the study were to determine the following: (1) effect of additives in coating wet aggregates with bitumen; (2) effect of additives in reducing film stripping; (3) effect of varying percentages of additives; (4) effect of additives on the characteristics of bituminous materials with which they are used; (5) effect of additives when used with different bituminous materials; (6) effect of additives in reducing loss of strength of bituminous mixtures due to water action; and (7) permanency of benefit obtained by the use of additives.

Early Research Reviewed

In this study, seven additives were used, as received and in accordance with the recommendations of the producers; except that, for test purposes, the percentage of additives used was varied. All were combined directly with the asphalt.

The bituminous materials used were 120-150 penetration asphalt, MC-2 and RC-2 cutback asphalts, and RT-5 road tar. After the introduction of the additives to these binders, the three liquid materials were analyzed. The thin-film oven test, which is an accelrated weathering test, showed that no detrimental effects attributable to the additive could be expected to develop as a result of oxidation of the bitumen in service.

The aggregates used in the investigation included two different gravels, two different granites, a quartzite, a limestone, a lime rock (altered diabase) and a trap rock, thus covering both the hydrophilic and hydrophobic types.

The tests used were as follows: (1) the modified Oberbach Test, a static immersion test; (2) the modified Nicholson Test, a dynamic immersion test, and (3) the Immersion-Compression Test as reported in this same issue of *Public Roads*.

In the stripping tests, only the ⅜ in. No. 4 fractions of aggregate were used. The aggregate used in the immersion-compression test was composed of five different coarse aggregates graded from ½ in. to No. 10, Potomac River sand, and silica dust. The stripping tests were made on aggregate coated in a wet condition as well as those coated dry. In order to obtain indications regarding the permanence of the beneficial effects of the additives, one group of the immersion-compression test specimens was subjected to alternating immersion and drying over a 74-day period. Each cycle consisted of four days immersion and 10 days storage in air.

In summarizing the results of the investigation, the following statements were considered by the authors to be warranted: (1) Additives were available that facilitate the coating of wet aggregate with liquid bituminous materials. (2) Additives were available that greatly increased the resistance of bituminous films to stripping in the presence of moisture. (3) The use of additives with tar did not appear to be warranted except possibly when mixing must be done under particularly adverse conditions such as during or just before a rain. (4) Additives appeared to have no detrimental effect upon the bituminous material with which they were used. (5) Additives appeared to have no material effect on the original compressive strength of bituminous mixtures. (6) Additives were available that would reduce the loss of stability of bituminous mixtures due to the detrimental action of water. (7) The benefits afforded by additives appeared to have considerable permanence but the degree of permanence was not disclosed by these tests. (8) The immersion-compression test provided a useful measure of the benefits to be derived from the use of additives.

As this study was primarily to establish the effectiveness of additives when used with wet aggregates, which problem had originally prompted the developments of such additives, no attempt was made in the investigation to evaluate the advantages, if any, to be gained in the use of additives in bituminous mixtures for hot-mixed and hot-laid pavements.

Use in Hot Mixes

The general opinion in plant mix circles until quite recently has been that anti-stripping additives would be of little value in such hot mix pavements due to the favorable conditions under which the aggregate and asphalts are mixed, laid, and compacted, and the resulting dense, comparatively impervious mat which was presumed to inhibit, if not eliminate, the possibility of asphalt stripping. However, sufficient investigative work has been done in connection with bituminous hot mix pavement failures to indicate that film stripping had occurred, generally beginning at the bottom of the pavement where the moisture conditions for stripping prevail, and progressing gradually upward, its progress being closely related to the density of the mat. To provide protection against such stripping, the use of commercial additives for treating the asphalt was adopted.

Contrary to expectations, the results were not entirely satisfactory. Instances developed where pavements incorporating additives acceptable on the basis of indicated benefit in laboratory mixtures later evidenced stripping. From such experiences, the

opinion developed that additives, as currently produced, might not be stable at the temperatures obtaining in hot-mix work or during shipment from the refinery to the job prior to use.

As a result of these developments, maufacturers undertook the production of additives that would be resistant to the heat to which they would be subjected during shipment and plant mixing. Subsequently, commercial materials for which such properties were claimed, were placed on the market.

To determine to what extent these materials were heat resistant, the Bureau of Public Roads conducted a study in which asphalt cement treated with an additive, and asphalt cement untreated, were heated to two different temperatures, (250° F. and 325° F.), and these combined with aggregates which had also been heated to two different temperatures (300° F. and 400° F.). The resultant mixtures were then formed into test specimens which were subjected to the immersion-compression test. This study was reported by Paul F. Critz in the August 1954 issue of *Public Roads* magazine. The results of this investigation, with respect to the three additives which were tested with asphalt from one source, were summarized as follows:

Prolonged Heating

1. Prolonged heating of the treated asphalt at high temperatures prior to mixing reduced the effectiveness of the additives. For these tests, heating at 325° F. for 72 hours practically destroyed the effectiveness of the additives, as measured by the results of the immersion-compression test; however, it is known that the effect of heating is much more detrimental to small masses of asphalt than to large ones. Therefore, it may be concluded that for the same temperatures and periods of heating that were used in these tests, much less severe reductions in the effectiveness of the additives would take place in practice where the asphalt is held at elevated temperatures in large masses.

2. Overheating the aggregate reduced the effectiveness of the additives more than did prolonged heating of the treated asphalt prior to mixing. It may be noted that mixing operations, as performed in connection with this investigation, much more nearly simulated the conditions of practice than did the preliminary heating of the asphalt.

3. Even under the severe conditions of these tests the additives, with only a few exceptions, were effective in specimens subjected to the immersion-compression test on increasing the percentage of retained strength and in reducing the moisture absorption and volumetric swell.

From these results, it was concluded that if proper attention is given to the control of the temperature of the asphalt and the aggregate, particularly the latter, the additives studied in this investigation may be expected to reduce the detrimental effects of moisture in hot-mixed asphaltic pavements containing hydrophilic aggregates.

Now Widely Used

The foregoing is a rather general review of the need for, development, and performance testing of commercial anti-stripping additives, a number of which have been with us for 10 years or more. A measure of the acceptance of these materials by the highway industry is the wide use now made of them, both nationally and internationally. An indication of this general acceptance is evidenced by the replies to a questionnaire on "Adhesion Tests of Bituminous Materials" submitted to the 48 state highway departments, the District of Columbia, U. S. Bureau of Reclamation, and the Department of the Army, Vicksburg, Mississippi, by the Highway Research Board Committee A-2 (Committee on the Deterioration of Bituminous Pavements by the Effect of Water) in January of 1952, and summarized on pages 42 and 43 of Highway Research Board publication 332 entitled "Effect of Water on Bitumen-Aggregate Mixtures."

Of the 40 organizations replying, seven have established lists of approved anti-stripping additives, 14 others indicated the use of additives is permitted but the additives are not restricted to an approved list, and three others indicated additives are used under certain conditions.

Therefore, it may be safely inferred from this summary that at least 24, or 47%, of the 51 organizations provided the questionnaire look with favor upon the use of additives in dealing with asphalt film stripping problems in bituminous construction.

When one considers that a number of the states are so geographically located that stripping does not constitute a problem and, therefore, the need for such additives does not arise, this percentage is conservative and should be adjusted upward to reflect more accurately the general use made of these materials in regions where their full capabilities may be realized. That such a percentage of the highway industry makes use of these additives, is, in itself, a testimonial of generally satisfactory job performance.

The bulk of the data advanced which might be thought to discredit the use of additives is more truly a condemnation of the indiscriminate use of these materials without thorough laboratory analysis of the conditions involved to serve as a factual basis for the selection of the proper additive, amount of additive, type of bitumen, etc., required to produce the desired results with the available aggregate.

However, it has been conclusively shown by test and by field performance that with certain aggregate-asphalt combinations, certain additives not only fail to accomplish their intended purpose, but actually produce results inferior to those which would have been gained otherwise. To hail anti-stripping additives as the panacea for all stripping problems would be to ignore the true facts surrounding the use of these agents.

Of the objections which have developed to the use of additives, the most common are: (1) cost, and (2) problems attending the introduction of the additive into the asphalt.

The former, of course, is the first consideration in all phases of a competitive construction industry, and, therefore, the additional cost to bituminous construction by virtue of the additive must be justified on the basis of anticipated benefit.

Additives No Panacea

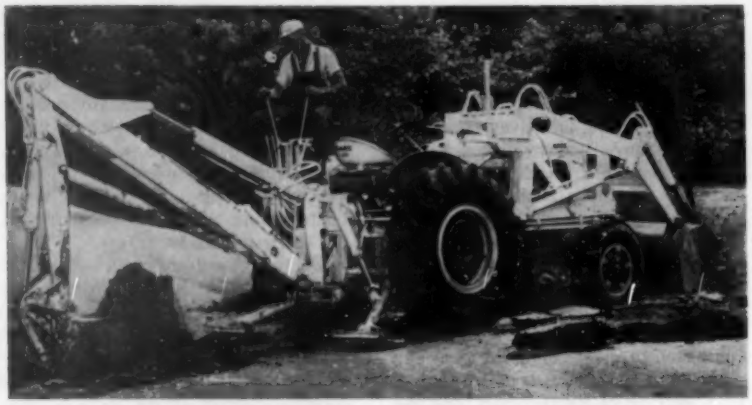
Regarding the second item, addition of the anti-stripping agent to the asphalt at the refinery immediately prior to shipment aids in the thorough mixing of the two materials, but, lacking rapid field tests which can be made on the combination, no positive evaluation can be made later to confirm the type or percentage of additive included. Field mixing avoids this problem, but introduces the problem of thorough mixing. Storage, at refineries, of asphalts which have been treated with additives, along with untreated asphalts, also poses a problem.

It may be concluded from the foregoing that there are anti-stripping agents available on the competitive market of today which have successfully run the gamut of laboratory investigation and field performance. Through them, American Industry has provided the highway engineer a valuable tool to aid him in his attempts to solve, or at least to minimize, the asphalt film stripping problem in bituminous road construction.

As with all tools, however, their value can only be in proportion to the intelligent, judicious use made of them, in which cognizance is taken of both their capabilities and their limitations.

What's New
in Equipment and Materials

Reader Service Coupon on Page 16



Ottawa Backhoe and Front End Loader Combination on Case 420 Tractor

Front End Loader and Backhoe For Case Tractors

Ottawa Steel Division of L. A. Young Spring & Wire Corporation, P. O. Box 39, Ottawa, Kans., is now manufacturing the Ottawa front end loader and backhoe for the new J. I. Case Co. 420 and 425 tractors.

The backhoe is available in two models for each tractor. One model digs 8½ ft. deep, the other 11 ft. deep. The backhoe features a hydraulically actuated bucket which makes it possible to retain the material while loading into trucks over 8½ ft. in height. Automatic ejector buckets are available for insuring full dump of every load of clay, or other sticky material. The patented dual "One-Trol" levers permit the operator to coordinate all movements of the bucket, stick, and boom with only two control levers.

For more information circle 114 on Service Coupon Page 16 and mail now.

Highway Maintenance Truck And Sander

A new general highway maintenance truck, Model M-264, announced by Four Wheel Drive Auto Co., Clintonville, Wis., is characterized by its versatility. Equipped with dump body and under body blade, the four-wheel-drive truck can be utilized for ice control, snow plowing and hauling in the winter months. In warm weather, the FWD Model M-264 can be equipped for road grading and any special body can be adapted to general highway maintenance or heavy-duty hauling.

The Model M-264 has a 6 yd. dump body and new, fully-hydraulic Wausau hopper-type spreader which can be used to distribute sand, salt, calcium chloride, or any similar loose material. The dump body sander uses the injector method of feeding the material spinner. Width of spreading is controllable from 40 ft. on down and the speed of feed is variable. The unit also has automatic deflectors so the sand or other material can be shut off to one side in traffic.

Model M-264 FWD Trucks

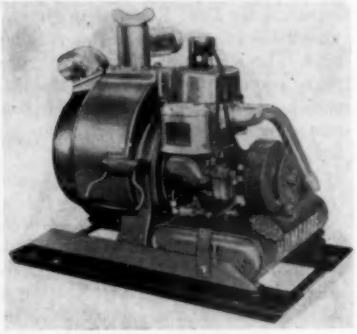
Despite the ruggedness built into the new Model M-264 on which this dump body and sander are mounted, the unit is lighter in weight and has greater payload capacity because of FWD's tapered-front, heat-treated alloy steel frame, new axle construction, and new engine.

The Model M-264 has an RD-372 gas engine with 165 BHP at 3,200 RPM and 309 lbs. ft. torque at 1,600 RPM. The 26,000 GVW truck (rating is subject to variation depending upon the type of operation) is available with diesel engine if desired. Streamlined cab and body design includes a 40 gal. step tank for fuel. FWD's fully-compensating center differential can be engineered on a 50-50 basis or a one-third, two-thirds ratio with patented new power-proportioning.

For more information circle 115 on Service Coupon Page 16 and mail now.

Pump Works at Low-Noise-Level

A new self-priming, centrifugal pump (Model 36S2), announced by Homelite, a division of Textron American, Inc., Riverdale Ave., Port Chester, N. Y., is designed to work efficiently at low-noise-level, slow speed operation, yet deliver a full capacity of 9,000 gal. per hour. The new Model 36S2 is equipped with a carburetor that can be throttled down to permit high "on the job" capacity yet "whispers while it works." The Homelite 36S2 weighs only 87 lb. Fast to set up, quick to start, the 36S2 has a guaranteed 28 ft. suction lift and 65 ft. total head including friction. Automatic-priming at 5-ft. suction lift takes just 9 seconds! The automatic seepage control keeps water right down to strainer level for dry working conditions.



Model 36S2 Homelite Pump

Powered by a single-cylinder, air-cooled, two-cycle Homelite gasoline engine governed for speeds between 2,550 and 2,650 rpm at open throttle, the 36S2 Homelite pump can be reduced to quiet speeds between 1,200 and 1,500 rpm by simply closing the throttle.

For more information circle 116 on Service Coupon Page 16 and mail now.

Tractor Shovel

Another completely new and larger 2-wheel-drive "Payloader" tractor shovel, Model HAH, announced by The Frank G. Hough Co., 768 Seventh St., Libertyville, Illinois, U. S. A., features "pry-out" bucket action, 40 degrees of breakout at ground level, and new safety and stability standards. The new model, which has a struck capacity of ¾ cu. yd. and a heaped capacity of 1 cu. yd., incorporates all the features of the smaller "HA" model which was introduced in February of 1955 after three years of development and field testing.

Of particular interest is the bucket breakout action which permits 40 degrees

of tip-back at ground level. The new model "HAH" has a breakout force of 4,500 lb., a lifting capacity of 4,000 lb. and a carrying capacity of 3,000 lb. at 4 mph.

Model HAH "Payloader"

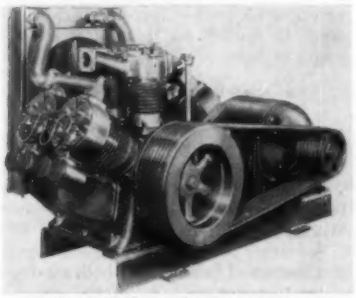
Especially designed for stockpile work, this new unit has a short turning radius and rear-wheel power steering for fast maneuverability. The high lift of 7 ft. 9 in. makes it easy to load trucks or elevated hoppers.

Torque-converter-drive and 4-speed full-reversing transmission are combined with gas engine developing 57 hp and travel speeds range from 0 to 14 mph in forward and from 0 to 23 mph in reverse.

For more information circle 117 on Service Coupon Page 16 and mail now.

50 to 100 HP Stationary Compressors

A new line of two-stage, air-cooled, electric motor driven compressors has been announced by the Le Roi Division of Westinghouse Air Brake Co., 1706 S. 68th St., Milwaukee, Wis. These new 50, 75 and 100 hp stationary compressors have displacements of 260, 415, and 550 cfm at 125 psi operating pressure. The new 3 cylinder 50S2 and 6-cylinder 75S2 and 100S2 compressors have a balanced design which reduces vibration and noise to a minimum.



Six-Cylinder 75S2 Compressor

Cylinders are made of alloy iron and are cooled by a high-speed, belt-driven fan which draws air through a sectional-core intercooler and directs air over the cylinders and heads. Air cooling allows installation of the "S" compressor without fear of interruption in the flow of water or freezing of water lines. Each bank of cylinders has individual intake filters. Forced feed lubrication, by a positive plunger type oil pump, adds to the dependable service of the compressor with the least amount of attention.

For more information circle 118 on Service Coupon Page 16 and mail now.

ROSCO'S PRESSURE METERING

MAKES THE DIFFERENCE

AT ANY WIDTH!

Do you know . . .

that it's possible to apply bitumen through any length of spraybar from 1 to 24 feet *without changing the pressure and without any application adjustment?* It can be done with a Rosco! You would normally expect surges or drops in pressure to occur when sections of a distributor's spraybar are shut-off or turned on.

But . . .

NOT with a Rosco Distributor equipped with exclusive Pressure Metering. Even when as much as 23 feet of a 24-foot spraybar are shut-off, the precise, accurate delivery remains unaffected . . . the pressure in the working one foot stays the same as it was pre-set at the beginning of the run. The accurate delivery from the working nozzles is not affected . . . no matter how many feet of the bar are cut out.

No adjustments in truck or pump speed are required—in fact, with Pressure Metering the pump speed never changes and normal wear of the pump never affects the accuracy of the application. When any part of the spraybar is shut off, the excess material is automatically by-passed. Pressure at the operating nozzles stays the same. When additional nozzles are turned on, pressure is immediately available to supply them.

One control sets the pressure specified for the job. After that, pressure control is automatic . . . the operator can concentrate full attention to spotting the material properly on the road. Pressure Metering is an integral part of Rosco's patented Master Valve that permits one-lever control of all normal distributor functions. You'll find that Rosco's Pressure Metering is faster and more accurate —factors which can be the difference between a "make" or "break" job in today's highly competitive field. And Rosco's Pressure Metering assures you of jobs that will always meet rigid application specifications.

Let your Rosco dealer show you how Pressure Metering will pay off for you. Or write the factory for descriptive literature with specifications on Pressure Metering-equipped Distributors.

ROSCO BITUMINOUS DISTRIBUTOR with Pressure Metering. Front or rear mounted for truck or trailer.

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DISTRIBUTORS • MAINTAINERS • BROOMS
SUPPLY TANKS • TAR KETTLES • STREET FLUSHERS

. . . for more details circle 227, page 16

Allis-Chalmers 23,800-lb. Forty-Five Motor Grader

Heavy Duty Motor Grader

A new heavy duty motor grader, the Forty-Five, introduced by Tractor Group, Allis-Chalmers Manufacturing Co., Milwaukee, Wis. is powered by the new Allis-Chalmers ADS-516 six-cylinder, 4-cycle diesel engine with its rated 120 maximum brake h.p. at 1600 rpm.

The Forty-Five motor grader weighs 23,800 lb., of which two-thirds or 17,375 lb. is on the tandem drive rear wheels, and 6,425 lb. on the front wheels. Blade pressure is 10,950 lb.

The diesel engine used in the Forty-Five has a 4-7/16 in. bore and 5-9/16 in. stroke, with a 516 cu. in. piston displacement. It delivers power for forward speeds up to 20.6 mph and up to 7 mph in reverse. The grader can be throttled down, under governor control, to one-half these rated speeds without loss of rim pull.

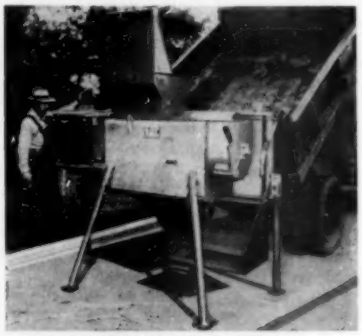
An outstanding development incorporated in the Forty-Five is an exclusive finger-tip control box with toggle-type linkage affording increased leaverage for smooth, effortless, accurate operation of moldboard, wheel lean and scrifier.

Other basic design features of the Forty-Five include numerous advancements and developments in engineering and construction that increase potential productivity and life of the grader and add to operator comfort, safety and performance.

For more information circle 119 on Service Coupon Page 16 and mail now.

Asphalt-Patch Mixer

A new, improved Model (30-R) Heat-A-Mix tail gate asphalt-patch mixer has been announced by Wylie Manufacturing Co., Inc., 5926 N. W. 39th St., Oklahoma City 12, Okla. Heat-A-Mix is a compact, high-capacity pugmill and material heater, self-contained with its own gasoline engine and propane or kerosene heating system.



Model 30R Heat-A-Mix

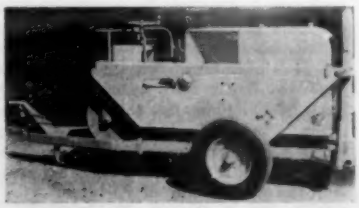
New features include a forward-and-reverse transmission, which make it possible to retain material in the pugmill until it reaches the temperature desired. At the same time, the design of the heat-jacketed pugmill makes it flash-proof, with no direct flame in contact with asphalt material. The entire unit, by means of its new removable, adjustable legs, can now be quickly transferred from one truck to another on the road without a crane or hoist.

For more information circle 120 on Service Coupon Page 16 and mail now.

Tandem Roller

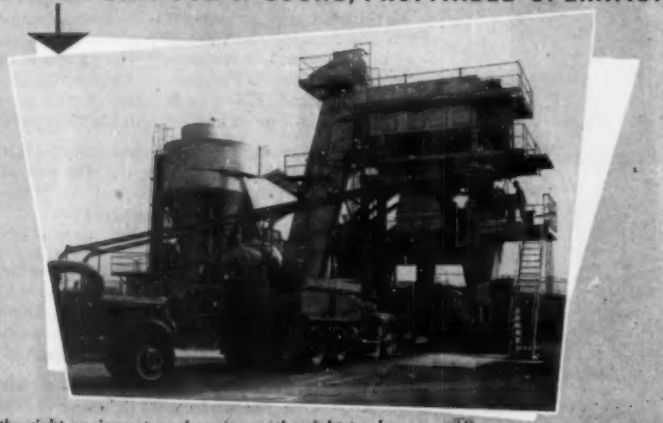
A new tandem roller, Model 55, has been announced by Standard Steel Works, North Kansas City, Mo.

A feature of the Model 55 is the even distribution of ballasting in both steel and water to provide 1½ to 2½ ton compaction. For various weights needed from light patching to wide roll dimensions for smooth finishing, steel ballasts are removable in 70 lb. sections for a variety of



Model 55 Tandem Roller

STARTING POINT FOR A SOUND, PROFITABLE OPERATION



Select the right equipment, and you're on the right track for a sound, profitable operation. In an asphalt plant . . . the right equipment is MADSEN. MADSEN Asphalt Plants are designed and built from the owner-operator point of view. The MADSEN Model 481, for example, has more than 25 special features and advantages to help you turn out bituminous mixes at a faster, sustained rate . . . to help make the plant operator's job easier . . . and to lower plant maintenance costs.
For the big road-building months and years ahead, be sure you start with the right equipment. Take the first step, and talk with your MADSEN Distributor now.

MADSEN Equipment that Serves

MADSEN
MODEL 481
ASPHALT PLANT

MADSEN WORKS
CONSTRUCTION EQUIPMENT DIVISION
Baldwin-Lima-Hamilton Corporation
14120 E. ROSECRANS AVE., P. O. BOX 38 • LA MIRADA, CALIF., U. S. A.

Ask your MADSEN Distributor for complete details

BLH Construction Equipment Division

. . . for more details circle 221, page 16

compaction ranges. Model 55 will roll to within 2 in. of walks or other obstructions on the driver's side. Eight inch ground clearance provides flush rolling to curbings.

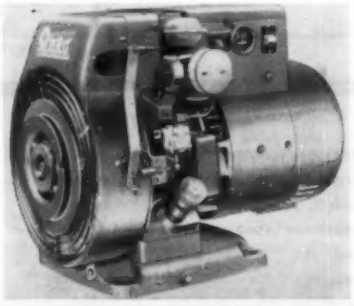
Automotive steering, finger tip controls, automotive type foot brake pedal, speed controller and throttle as well as water valve are easily handled from upholstered drivers seat. Overall length is only 103 in.

In addition, a trailer is available for transporting the unit from job to job. One man can easily load the roller on the ramp-type trailer, hitch the unit to a vehicle and drive away, all within a few minutes.

For more information circle 121 on Service Coupon Page 16 and mail now.

2000 Watt AC Electric Plant

A new electric generating plant, Model 2LK, has been announced by D. W. Onan & Sons, Inc., Minneapolis 14, Minn. Onan Model 2LK produces 2,000 watts, 60-cycle, A. C. at 1800 rpm (or 1,500 watts in 50-cycle) in all standard frequencies and phases. An extremely compact unit, weighing 235 lb., the LK unit was built specifically for rugged, heavy-duty service. Model LK is powered by



Onan Model 2LK Electric Plant

an Onan single-cylinder, air-cooled, 4-cycle gasoline engine with Stellite-faced rotating exhaust valve, large long-wearing bearings and efficient trouble-free air-cooling.

A conservatively rated, blower-cooled Onan generator is direct-connected to the engine for permanent alignment. Completely self-contained manual starting models are equipped with patented recoil rope starter, mounted fuel tank, muffler, air-cleaner, terminal box and vibration dampeners. Electrically cranked remote starting models come equipped with mounted control box, exhaust tubing and muffler, air-cleaner, separate fuel tank and battery cables.

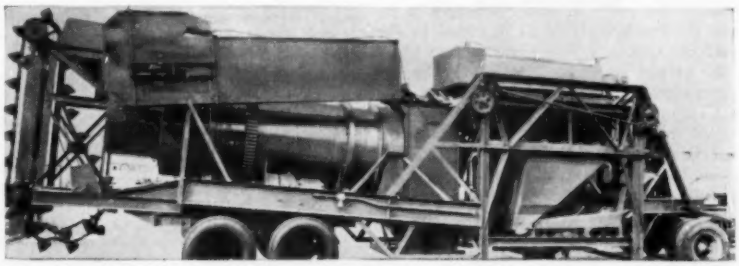
Radio shielding on high tension wire and spark plug is standard equipment for all models.

For more information circle 122 on Service Coupon Page 16 and mail now.

Announcing
A NEW
STANDARD

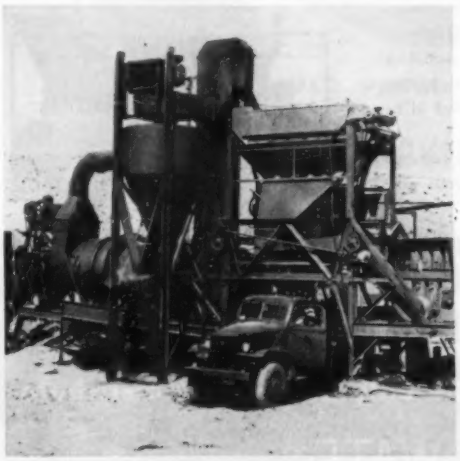
PORTABLE BATCH TYPE ASPHALT PLANT
(MODEL TM)

At last . . . a completely portable *batch type* asphalt plant . . . designed to meet the demand for a plant portable enough to move economically yet provide the capacity and accuracy required for specification work. Capacity is 40 to 50 tons per hour. Ordinarily operated by one man. The exclusive STANDARD "Self-Lift" erecting device elevates the mixing cage in as little as 30 minutes. Fast dismantling, hauling and erecting eliminates need for long, expensive asphalt hauls.



HAUL IT *Anywhere!* Perfect for rural areas . . . for hard-to-reach locations, for state highways and county and township roads. Truck tractor hauls plant easily. Now you can profitably handle jobs that size and distance formerly eliminated or made extremely expensive.

READY for OPERATION— *In A Few Hours!*



The push button operated "Self-Lift" *automatically* raises or lowers the mixing section in minutes. The entire unit, including cold and hot elevator, can be put in working position in as little as 2½ hours. Estimated erection or dismantling time for complete plant, including boiler and storage tank, is approximately one day. Built for years of the most rugged service, the STANDARD portable plant will stand up under both heavy asphalt production and the added stress and strain of constant erection, dismantling and road shock.

Send today for bulletin giving full information on the STANDARD Model TM, Portable Asphalt Plant

10-PR

STANDARD 52 YEARS 1904-1956

STANDARD STEEL CORPORATION
5003 BOYLE AVENUE, LOS ANGELES 58
15 PARK ROW, NEW YORK 3

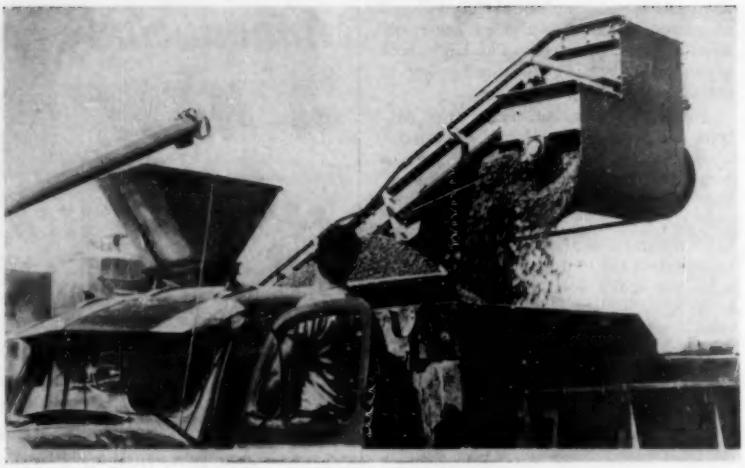
. . . for more details circle 244, page 16

Stabilized Aggregates Mixing Units Reduce Dust

A new delivery conveyor attachment that thoroughly mixes water and calcium chloride with aggregate, before it is discharged from surge bins or gravel plants into a truck body, has been announced by Iowa Manufacturing Co., Cedar Rapids, Ia. The Cedarapids mixing unit is claimed to eliminate the need of other sprinkling or spraying equipment on the road bed and to provide much more accurately controlled proportioning of calcium chloride and moisture.

The mixing unit, called the Cedarapids volumetric proportioning continuous mixing type pugmill attachment, fits under the head pulley of a delivery conveyor. Optional equipment which adapt the unit to various road surfacing methods include a calcium chloride feeder, a water meter, a quick-close valve, and a water pump. The mixing unit contains an 18-paddle pugmill which thoroughly mixes the material and discharges it into the truck body. Also included in the mixing unit is a 2-in. spray bar to spray the proper amount of water into the aggregate as it is mixed.

The calcium chloride feeder, which is used in most installations, consists of an enclosed bin unit and a short conveyor belt to add a controlled amount of calcium chloride to the aggregate on the delivery conveyor belt. This unit is driven by the conveyor power unit.



Pugmill Conveyor Attachment

The new equipment can be added to the delivery conveyors of all types of portable and stationary surge bins and is available on special Cedarapids 5 and 10 yd. portable bin units.

With special adaption, the unit can be fitted on the delivery conveyor belts of portable gravel crushing and screening plants.

For more information circle 123 on Service Coupon Page 16 and mail now.

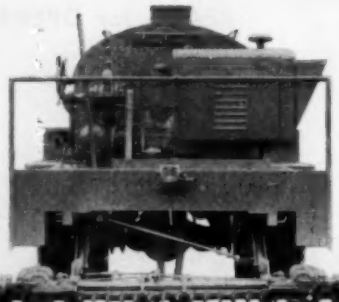
Crawler Tractor and Tractor Shovel

Two new diesel-powered units, the 12,400 lb. HD-6 crawler tractor and the 19,600 lb. HD-6G tractor shovel with a rated capacity of 1¼ cu. yd., have been announced by Tractor Group, Allis-Chalmers Manufacturing Co., Box 512, Milwaukee 1, Wisconsin, U. S. A.

Many features found in other crawler tractor models recently introduced by

"HALF the weight of the ordinary spray bar and twice as effective." That's what the many satisfied SPRAY-MASTER owners are saying about the exclusive Littleford LITE-WATE spray bar.

And there are many other reasons why the SPRAY-MASTER is tops with blacktop contractors—low fuel oil cost, larger pump capacity, single valve control, rear end loading, hand spray attachment, spray bars up to 24-ft. wide, and your choice of truck or trailer mounting. For complete information, write for free bulletin 14. Littleford Bros., Inc., 454 East Pearl Street, Cincinnati 2, Ohio.



LITTLEFORD "SPRAY-MASTER"

Equipment with BUILT-IN ENGINEERING LITTLEFORD

the only bituminous distributor with the

LITE-WATE

end folding

full circulating

spray bar!

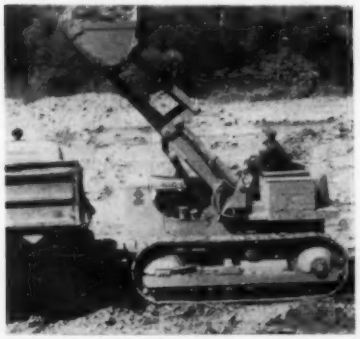
. . . for more details circle 217, page 16

HD-6 Crawler Tractor

Allis-Chalmers, including the HD-21, HD-16, and the HD-11 and HD-11G, are incorporated in the HD-6 and HD-6G. These include the new Allis-Chalmers Diesel engine with follow-through combustion; the "Wrap-Around" radiator guard; tough All-Steel Box-Type "A" main frame, one-piece line-bored steering clutch and final drive housing; straddle-mounted double reduction final drive gears mounted on tapered roller bearings to reduce gear spreading and corner loading of gears; roller bearing truck wheels with 1000-hour lubrication; Tru-Dimension tracks designed for long life and maximum toughness of all parts; and extra long life ceramic master clutch lining.

The heart of the HD-6 and HD-6G's newly engineered power train is the Allis Chalmers HD-344 diesel engine, a 4 cylinder, 4-cycle unit that develops 57 net flywheel hp, 45 hp at drawbar and 55 hp at the belt.

In the HD-6 the maximum drawbar pull is approximately 12,650 lb. It has five forward speeds ranging from 1.5 mph in first to 5.5 in fifth gear, and 2 mph in reverse. The HD-6G has four forward speeds which also range from 1.5 to 5.5, and two reverse speeds at 2 to 4.1 mph.



HD-6G Tractor Shovel

The HD-6G offers as standard equipment six truck wheels per side with 83-3/16 in. of track on the ground for maximum stability without use of counterweights; 1½ cu. yd., two position bucket; new type shovel hydraulic system with triple filter protection; semi-grouser track shoes; full truck frame guard equipment; heavy duty front idlers; pusher fan; and "Wrap-Around" radiator guard.

For more information circle 124 on Service Coupon Page 16 and mail now.

Roller Has Roll-O-Matic Drive

Major improvements in Galion "Chief" 3-wheel roller to increase performance, ease of operation, length of service, and adaptability to the needs of users, have been announced by The Galion Iron Works & Mfg. Co., Galion, Ohio.

The "Chief" is available with either ballastable-type rolls, or with non-ballastable spoke-type rolls. Four sizes offer a weight range from 10 to 16 tons. Standard width of drive rolls is 20 in., with 24 in., width available. Rolling speeds from .8 to 5.5 MPH are available.

Outstanding among the listed improvements is the Galion Roll-O-Matic torque converter (GM-Allison) drive supplied as standard equipment. This drive automatically multiplies engine torque and provides an infinite number of drive ratios to suit any working conditions.

The Galion Roll-O-Matic torque converter drive has no gear shift mechanism. Furthermore, it automatically multiplies the engine driving force by means of oil in motion instead of by transmission gears. It automatically applies the driving force as the work demands, and automatically maintains desired rolling speed regardless of grade or working conditions. This desired rolling speed is maintained whether working up hill, down hill, or on the level.

For more information circle 125 on Service Coupon Page 16 and mail now.

HOW MOTO-PAVER PAVED THE WAY TO

An economical paving program for small cities and towns

A simple yet economical and unique construction program is providing the city of Andrews, Texas, with a network of paved streets probably unequaled in any other town of its size (population 8,000). The project calls for 300 city blocks to be paved, complete with curbs and gutters, in widths from 33 to 60 ft., and averaging 40 ft.

The techniques and methods of operation utilized by the contractors, Centex Paving Co., of San Antonio, have resulted in a most economical program, according to Jim Dailey, Centex president. Says Mr. Dailey: "The two greatest factors in the economy of the program are: 1. Utilization of a Hetherington & Berner Moto-Paver, and 2. Production of asphaltic concrete aggregate from material at the local pit."

Heavy rains in the Andrews section of Texas gave officials and contractors an excellent opportunity to test the quality of the work. One street laid about the first of July was under water from one to three feet deep five different times. An estimated 10 inches of rain fell—most of it in flash floods. Inspectors found no soft spots, no cracks—no evidence of any kind of damage.

For complete information on how Moto-Paver can help *you* to "speed the job—cut the cost," see your local H&B distributor, or write direct for Bulletin MP-55.

HETHERINGTON & BERNER INC.

ENGINEERS...MANUFACTURERS

721 KENTUCKY AVENUE INDIANAPOLIS 7, INDIANA

. . . for more details circle 206, page 16

Manufacturers' Literature

Steel Bridge Plank

Manual BP-8455, a new publication from Armco Drainage & Metal Products, Inc., deals with Armco bridge plank, a corrugated steel flooring material for new or existing structures. Design of the product consists of a 2-in. deep trapezoidal corrugations in 2-ft. wide steel planks. When welded to bridge stringers, Armco bridge planks are said to provide a firm base for a smooth bituminous traffic surface.

The 16-page manual contains charts, tables, engineering details and design data, a section on recommended installation practice, and a photographic record of actual bridge plant installations. Write to Product Information Service, Armco Drainage & Metal Products, Inc., 703 Curtis St., Middletown, Ohio, for copies.

For more information circle 126 on Service Coupon Page 16 and mail now.

Calcium Chloride for Roads

A 24-page illustrated booklet "The Why of Wyandotte Calcium Chloride for Roads" has been announced by Wyandotte Chemicals Corp.

The booklet explains, in copy and pictures, why calcium chloride has become so widely adopted for the treatment of unpaved road surfaces. Such topics as: elimination of gravel loss; reduced blading; lower cost of vehicle operations; etc. are covered.

Copies may be obtained by writing to Wyandotte Chemicals Corporation, Wyandotte, Mich., attention: Technical Literature Section.

For more information circle 127 on Service Coupon Page 16 and mail now.

Rotary Snow Plows

Bros Series "A" Sno-Flyer rotary snow plows are described in a 4-page folder issued by Wm. Bros Boiler and Manufacturing Co., Road Machinery Division, 1057 Tenth Ave., S. E., Minneapolis 14, Minn. These plows are the front-end loader mounted models for wheel-type tractors and jeeps. The folder shows how the Series "A" Rotary attaches to the front-end tractor loader with the same pins and connections used to attach the loader bucket. The plow also mounts on crawler tractors, motor graders and jeep trucks. Several makes of tractors equipped with the Series "A" are shown. A full explanation of how the non-clogging slit-spiral rotor operates is presented. Also there is a description of single-lane truck loading, how it is accomplished by the use of a fully rotating casting chute and its advantages in street snow removal. Complete specifications are given on the three Series "A" models which denote three cutting widths: A66 — 6 ft. 6 in.; A56 — 5 ft. 6 in.; and A 44 — 4 ft. 4 in.

For more information circle 128 on Service Coupon Page 16 and mail now.

Diesel Power Unit

The International UD-525 diesel power unit is described in a new booklet published by International Harvester Co. This power unit develops 115 HP at 1,800 rpm. Without radiator, fan or clutch — the UD-525 develops 121 HP at 1,800 rpm. This rugged 6-cylinder, 4-cycle diesel engine has a 15.4 to 1 compression ratio. Its heavy-duty construction includes a counterbalanced crankshaft, seven precision replaceable bearings, replaceable hardened cylinder sleeves, conduction cooled aluminum alloy pistons and chrome plated top piston rings.

Full specifications and performance charts on the UD-525 are included in the new pamphlet, as well as a listing of available attachments. The booklet may be obtained free of charge by writing to Consumer Relations Department, International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill.

For more information circle 129 on Service Coupon Page 16 and mail now.

Road Construction Equipment

General Roads Machines, Inc., North Main St., Niles, O., which started manufacturing operations early in 1955, has issued a file of its new products. The folio, which is available from the company, includes the following: 20-page folder on its new compacting screed finisher, 2-page broadside on its new subgrade planer, 2-page broadside on its curb and gutter forms, 4-page insert, containing general information on its products.

For more information circle 130 on Service Coupon Page 16 and mail now.

Trucks for Construction Industry

The White Motor Co. has issued a new sales folder with the title "Facts About White Six-Wheelers For The Construction Industry" with pertinent data for maximum efficiency of trucks in all phases of the construction industry. The booklet, prepared by the market research department of White, treats with special background information concerning engines, frames and axles for both on and off road service in various construction operations. It also illustrates many applications of White specialized design six-wheelers. Copies of the booklet are available from Advertising Department, The White Motor Company, Cleveland 1, O.

For more information circle 131 on Service Coupon Page 16 and mail now.

Mobile Radio Units

A new, 2-color, 4-page catalog (E-131) on its recently announced Twin-V line of mobile two way radio units has been released by Motorola Communications & Electronics, Inc., Technical Information Center, 4501 Augusta Blvd., Chicago 51, Ill. It provides a guide to the various factors to be considered in selecting equipment — available frequencies, types of power supplies, types of mounting and transmitter power outputs. Included is a detailed listing of ten features which help assure the radio user of optimum performance. Among these are interchangeability in mixed fleets of 6 and 12 volt cars, transmitter deviation limiting, ease of maintenance and availability of nation-wide service facilities.

For more information circle 132 on Service Coupon Page 16 and mail now.

Heat Machines

A new bulletin (LL-2220) descriptive of Fageol heat machines Models PW-189 and VO-168 has been announced by Fageol Heat Machine Division, R. D. Fageol Co., Kent, O. Complete specifications and application data on both machines is presented in detail. Both models are entirely self-contained, oil burning units that can be plugged into any electrical connection. The PW-189 delivers 189,000 B. T. U. per hour. The VO-168 has a heat output of 168,000 B.T.U. per hour when unvented and 130,000 B.T.U. when heat is vented.

For more information circle 133 on Service Coupon Page 16 and mail now.

Quarry Plants

A new 8-page catalog (D-105) covering its portable and stationary quarry plants for crushing and processing rock has been released by Diamond Iron Works Division of Goodman Manufacturing Co., Halstead St., and 48th Place, Chicago 9, Ill. It contains illustrations of quarry installations and equipment. Three flow charts representing typical quarry installations are included. Specifications are given for five models of portable primary plants.

For more information circle 134 on Service Coupon Page 16 and mail now.

Diesel Electric Plants

A new line of literature covering all its diesel generating plants has been issued by Universal Motor Co., Oshkosh, Wis. All the information covering engine details and generator specifications has been incorporated into one complete easy-to-read diesel folder. Photographs, sizes, speeds, models and general specifications are arranged in an easy-to find manner making a suitable selection quick and positive for any size plants ranging from 8KW up.

For more information circle 135 on Service Coupon Page 16 and mail now.

Twenty "Gradall" Attachments

A new booklet has been issued by Warner & Swasey Co. of Cleveland, Ohio, describing the line of attachments now available for its multi-purpose Gradall. Among the twenty items illustrated and described are various sizes and shapes of buckets, single toothed ripper, scraper blade, material handling buckets, grapple, concrete bucket, boom extensions, offset boom extensions, giant tongs, and a compaction roller.

Copies of this booklet entitled "How To Beat Competitive Bidding with Gradall Attachments" may be obtained from the Warner & Swasey Co., Gradall Division, Cleveland 3, Ohio.

For more information circle 136 on Service Coupon Page 16 and mail now.

Gas Cutting Machine

A new catalog on the 6B Oxygraph gas cutting machine is available from Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y. This multiple torch machine and its accessories are fully described and illustrated in the 12 page, 2-color booklet.

For more information circle 137 on Service Coupon Page 16 and mail now.

Self-Propelled Pneumatic Tired Roller

A new 4-page brochure on its SP-54 self-propelled pneumatic tired roller has been released by Wm. Bros. Boiler and Mfg. Co., Road Machinery Division, 1057 Tenth Ave., S. E., Minneapolis 14, Minn. The folder illustrates and describes many of the features of the SP-54 such as: torque converter drive for smooth easy flow of power to the drive line providing smooth take-off in all forward and reverse speeds; three-speed transmission which provides the same speeds in reverse as in the forward range; fast shuttle or reversing gear which saves time by eliminating shifting through the transmission when changing directions. Other features noted are controlled hydraulic steering, 18-ft. turning radius, 50 hp. Continental engine, double braking and panoramic visibility. A picture of the SP-54 towing a second roller is shown. A diagram illustrates how the roller provides full 100 percent surface coverage and equalized wheel load. Complete specifications are also given.

For more information circle 138 on Service Coupon Page 16 and mail now.

Crushing Resistance of Rocks

"Measuring the Crushing Resistance of Rocks and Ores" and "Measuring the Relative Abrasiveness of Rocks, Minerals and Ores" are the titles of two articles by Dr. Benjamin B. Burbank that have been published in a booklet. Copies of the booklet can be obtained free of charge from the Pennsylvania Crusher Division, West Chester, Penn.

For more information circle 139 on Service Coupon Page 16 and mail now.

Maintenance and Care of Clamshell Buckets

Practical help for clamshell bucket operators is graphically presented in a new bulletin (No. 2373-R) issued by Blaw-Knox Co., Farmers Bank Building, Pittsburgh, Penn. It contains 40 pages of illustrations and carefully indexed information including: How to use counterweights for maximum efficiency; When to increase or decrease bucket reeving; What makes bucket lips bend in or bow out; Cable life, as influenced by sheave diameters, or proper application of tag line, or application to crane, etc.; Welding procedures for building up worn cutting lips, repairing fractures, etc. in high carbon plate, and cast alloy steel. Numerous other items include a list of common abuses leading to early bucket failure and proper lubrication practices.

For more information circle 140 on Service Coupon Page 16 and mail now.

Ninety Industrial Rubber Products

Specifications and descriptions of 68 different rubber hose for every industrial and agricultural use are presented in the new 8-page catalog digest announced by the Industrial Rubber Division of the Thermoid Co., Trenton, N. J. Several of the hose types described are new additions to the Thermoid line and have only recently been added. In addition, the brochure contains data on nine types of conveyor belts, seven types of flat power transmission belting, multiple and fractional horsepower V-belts, chute lining, rubber sheet packing and industrial friction materials. Twenty-three cutaway photographs show hose, coupling and belt construction.

For more information circle 141 on Service Coupon Page 16 and mail now.

All-Hydraulic Hydrocrane

A new bulletin (H-5-1) describing Bucyrus-Erie's new all-hydraulic, truck-mounted H-5 Hydrocrane has been released by Bucyrus-Erie Co., South Milwaukee, Wis. The bulletin is supplemented by a separate 4-page specification list and is contained in a handy compact literature folder. Both are written in easy-to-read style and are amply illustrated with on-the-job photographs. The H-5 Hydrocrane is completely new from outrigger feet to boom tip. As a lifting crane it has a rated capacity of 9 tons; as a clamshell excavator it carries a ½-yd. bucket. It can also be equipped with a 39-in. lifting magnet. The H-5 is designed expressly for mounting on a conventional motor truck. Other features highlighted in the bulletin are: Travel speeds up to 50 mph along open highway; standard 2-piece boom (telescoping from 24 ft. to 36 ft. long) or optional high-lift, 3-piece boom (extendible from 25 ft. to 50 ft. long); precision hydraulic control; four patented outriggers which provide more stability, greater leverage without counterweight, and instant leveling; unique gooseneck construction at the boom point; welded steel boom; sturdy alloy steel revolving frame; ample deck machinery; self-power unit, and easy-to-operate fingertip controls.

For more information circle 142 on Service Coupon Page 16 and mail now.

Self-Propelled Chip Spreader

The self-propelled "Spread-Master" power spreader is illustrated and described in an 8-page brochure issued by Flaherty Mfg. Co., Inc., P. O. Box 1042, Pocatello, Idaho. The spreader weighs 14,000 lb., is 7 ft. 6 in. high and 20 ft. wide. Its width with spreader hopper attached is 13.6 ft. It has a spread hopper capacity of approximately 2 yd. Forward speeds range from 1 to 15 miles per hour and larger sprockets are available should more speed be desired. On one job last spring in Riverside County, California, where the Speed-Master was used, sealcoating of the entire 7.36 miles of the project was performed in nine working hours. The operation of the unit was such that joints were required only very infrequently, one section being sealed continuously for a distance of 5,000 ft. without the necessity of stopping to make a joint. Three rollers were required in order to keep up with the pace set by the chip spreading machine.

For more information circle 143 on Service Coupon Page 16 and mail now.

Water Batcher for Concrete Batching Plants

A new 4-page bulletin (K-18) describing a new semi-automatic water batcher for concrete batching plants is available from The Heltzel Steel Form & Iron Co., Warren, O. Fast and accurate, this new Heltzel water batcher is stated to enable the operator to faithfully discharge the exact amount of water specified either in pounds or gallons, even compensating for "mid-air" water. Simplified construction is stated to assure long trouble free life.

For more information circle 144 on Service Coupon Page 16 and mail now.

Diesel Pile Hammers; Gasoline Drills

A condensed catalogue No. 5510, containing 50 pages of technical data, brief description and photographs of vibratory equipment, feeders, conveyors, power tools, shaft seals, selenium retifiers, diesel pile hammers, gasoline hammer drills, electric hammers and other materials handling equipment, has been published by the Syntron Co., 384 Lexington Ave., Homer City, Pa. Information is included on complete line of all models of Syntron equipment.

For more information circle 145 on Service Coupon Page 16 and mail now.

20 Cu. Yd. Scraper

Engineering, design, construction and mechanical features of the new Allis-Chalmers TS-360 motor scraper that make it a "Big-Capacity" earth-moving unit are outlined in the new two-color catalog (MS-663) available from the Construction Machinery Division, Tractor Group, Allis-Chalmers Mfg. Co., Milwaukee, Wis. Photographs and drawings assist the reader to understand better the many advances incorporated in this 20 cu. yd. heaped or 15 cu. yd. struck capacity motor scraper powered by the 280 h.p. Allis-Chalmers diesel engine. Operator comforts that add to productivity capabilities of the TS-360 are also outlined, and complete specifications of the unit are included.

For more information circle 146 on Service Coupon Page 16 and mail now.

Regrinding Hydraulic Pump Rings

An interesting circular on regrinding vane hydraulic pump rings is available from Lubke and Meyers Machine Works, 1910 Franklin Ave., S. E., Minneapolis, Minn., which has a special machine for this work. The circular describes the savings that have resulted from this regrinding, and gives prices for various size rings. It is stated that this regrinding saves two thirds the cost of new rings.

For more information circle 147 on Service Coupon Page 16 and mail now.

Crawler Tractor

The technical and operating story of its new HD-16 crawler tractor is available in a new 2-color brochure issued by Allis-Chalmers Manufacturing Co., Tractor Group, Construction Machinery Division, Milwaukee, Wis.

The brochure includes a pictorial review of the design, engineering, and operating advancements which combine to make the HD-16 outstanding in its weight and h.p. classification. Also included are specifications and information on operator comforts which, with matched attachments and accessories available, mean sustained high production with the unit.

For more information circle 148 on Service Coupon Page 16 and mail now.

Overshot Loaders

Publication of 5 catalog specification sheets covering the complete line of Austin overshot loaders has been announced by the Austin Division, Central Ohio Steel Products Co., Galion, O. Describing Models 2-C, 4-C, 6-C, 7-C and 8-C respectively, the 2-color catalog sheets are illustrated with detail and action photographs of each Austin Loader, plus illustrations of available attachments. Dimensional drawings and condensed specifications pertaining to individual models are also shown.

Five Austin overshot loader models are now available. Suitable for mounting on Caterpillar D2, D4, D6, D7 or D8 tractors and with capacities ranging from 1 to 4 cu. yds.

For more information circle 149 on Service Coupon Page 16 and mail now.

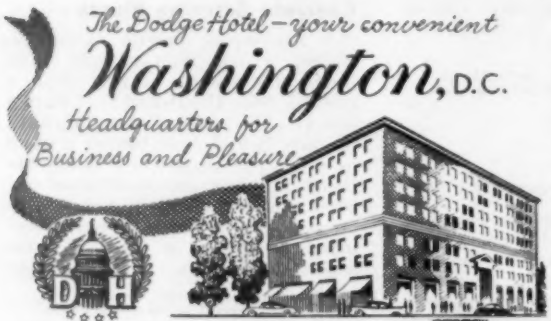
Material Handlers at Work

How to handle material efficiently is a large part of any industry's every day business. What machines to use for specific jobs and what machines are available are other important considerations. Such factors concerning the above are covered briefly in a new booklet, "Material Handlers at Work," Form No. D-565, issued by Caterpillar Tractor Co., Peoria, Ill. Actual customer jobs are discussed using different machines.

For more information circle 150 on Service Coupon Page 16 and mail now.

HARRY J. THOMPSON, formerly with the New Jersey Highway Department, has joined the Asphalt Institute as assistant to Herbert Spencer, Atlantic-Gulf Coast division engineer of the Institute, with headquarters at New York City.

G. BRYCE BENNETT, 34, has been appointed assistant state highway engineer of Idaho under state highway engineer E. V. Miller. He was formerly acting materials engineer for the Idaho department.



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CHICAGO

Thoughts on maintenance costs by force account

From Ohio Public Works, Published by Ohio Contractors Association, Charles E. McKee, Editor.

The rising cost of maintenance of our highways and streets to accommodate present-day traffic, has forced the responsible agencies to explore methods of reducing the outlay of capital investment for equipment and also reduce maintenance payrolls. In order to do this, these agencies have adopted the maintenance-by-contract method.

The fundamental objectives of any program of maintenance-by-contract are:

(1) Limitation of public equipment investment to economical and practical levels.

(2) Year-around stabilization of work forces.

(3) Relieving maintenance forces for strictly maintenance duties.

A survey made by an American Association of State Highway Officials committee of maintenance-by-contract performed by various State Highway Departments lists some 50 items of maintenance work performed by contract.

The equipment necessary for any political subdivision to perform these many diverse items of work amounts to a sizeable sum in tax dollars. Any political subdivision that is equipped and manned to do these many items of work will be faced with the unavoidable circumstance of the equipment and personnel being idle for 8 or 9 months and be needed 100% for only 3 or 4 months of the year.

The various political subdivisions should make an honest analysis of their costs of maintenance-by-force-account and compare them with contract costs.

The annual expenditures, on a Nationwide basis, made for street and highway maintenance have already crossed the billion dollar mark. If it is true that we ordinarily recognize private enterprise with its competitive initiative and ingenuity, as having certain advantages in our American way of life, then these advantages should not be overlocked in the vast programs of expenditures being made for highway maintenance.

Two fork trucks move 40,000 gallon tank

Using two fork trucks instead of rigging equipment enabled Auburndale Truck Company, industrial haulers of Toledo, Ohio, to move this 40,000 gal. storage tank 200 ft., in half the time and with less manpower than usual methods.

Clark fork trucks of 15,000 lb. capacity approached the tank from opposite sides, lifted it in unison and transported it to the new site, one truck traveling in reverse. The tank was moved in ten minutes; the whole job took four men six hours. Usual method would have required jacking and cribbing the tank to a height sufficient to back a carry-all under it for transport, then repeating the process to remove the carry-all and lower the tank. This would normally keep five or six men working 12 hours.

The tank, 25 ft. high and 20 ft. in diameter, holds a solution of caustic soda and water, used in the manufacture of bleach by Sinclair Manufacturing Company. Street widening made the move necessary.

TWO OHIO COMPANIES MERGE — The Hercules Steel Products Co. and Central Ohio Steel Products Co., have been merged. The new company, Hercules Galion Products, Inc., Galion, O. will have a working capital of approximately $4,000,000.

Manufacturers of products of the two companies will continue under present trade names and no changes will be made in distribution methods or distributor setups.

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ASPHALT COMPACTOR
AND ROLLERTAMPER

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Rolling Asphalt, Gravel, etc., Close to Walls

This portable, precision-built compactor is used for tamping and rolling asphalt close to walls, light poles, traffic signals and in all inaccessible places . . . and for use on all types of asphalt patching and repairing jobs.

Contractors, See Your Nearest Dealer, or Write

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. . . for more details circle 219, page 16

LUBRIPLATE No 630-AA IS PRACTICALLY A UNIVERSAL LUBRICANT

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"With the introduction of LUBRIPLATE No. 630-AA, we were able to satisfy all our needs for solid type lubricants with only two LUBRIPLATE Products. LUBRIPLATE No. 630-AA might almost be considered a universal lubricant. Furthermore, it has effected marked savings in both lubricants and labor!"

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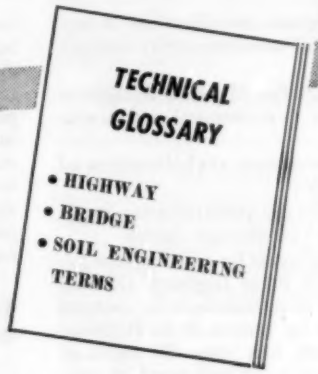
. . . for more details circle 218, page 16

JUST OFF THE PRESS

Technical Glossary — Glosario Técnico

An authoritative book written by the U. S. Bureau of Public Roads on Bridge, Highway, Construction, and Soils Engineering Terms

Authoritative Background Given Below



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★ ***20,000 English-Spanish***

★ ***17,000 Spanish-English Technical Terms***

★ ***Prepared by U. S. Bureau of Public Roads***

★ ***Preparation Cost in Excess of $45,000***

TECHNICAL GLOSSARY is a much needed work for use in translating English technical material into Spanish, or Spanish technical material into English, in order to convey the exact same idea and meaning to the reader of either language.

THIS BOOK was in process of preparation for a period of fifteen years. The preparation cost was in excess of $45,000.

The need of a specific glossary or dictionary of terms of this type has long been felt. After several International conferences between representatives of the U. S. Bureau of Public Roads and Latin American engineers, a decision was reached to prepare such a glossary. To further extend its usefulness, soil stabilization and associated laboratory work was included.

The manuscript for this book of over 35,000 terms was over 15 years in preparation under E. W. James, then Chief, Inter-American Regional Office, U. S. Bureau of Public Roads, working with the Library of Congress of the United States. It has been approved by a committee of five bilingual engineers of the Mexican government under the chairmanship of Sr. Ing. J. Fco. Rodríguez Cabo. It was then submitted to and approved by the "Academia Mexicana Correspondiente de la Academia Real Española" under the chairmanship of Sr. Don Martín Luis Guzmán, distinguished author, editor and publicist, also publisher of "El Tiempo."

It was then submitted to the V Pan American Highway Congress where a resolution was adopted commending the venture and recommending that the manuscript be published.

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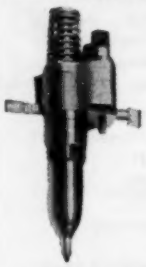

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2 D-8 Cable Bulldozers.
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2½ yd. Manitowoc 3500 Diesel Crane 1948.
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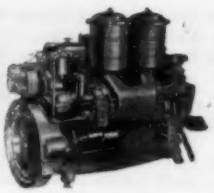

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1 Lorain Model L80 Shovel. Serial No. 10004. Equipped with Waukesha WAKH Engine, with standard boom and a 1¾ c.y. bucket.

1 New Esco 2½ c.y. Bucket. Serial No. 6792.

1 Lorain Model 820J Shovel, three (3) fronts available, a 1¾ yd. Bucket, equipped with Waukesha WAKD Diesel Engine.

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With the Manufacturers and Distributors

OTTAWA STEEL, INC. CHANGES HANDS — L. A. Young Spring and Wire Corp., Detroit, Mich., has purchased Ottawa Steel, Inc., Ottawa, Kan., and it becomes the Ottawa Steel Division of the purchaser. Edwin L. Johnson, previously associated with the management of Ottawa Steel, Inc., has been appointed general manager of Ottawa Steel Division.

MULTI-MATIC CORP. CHANGES NAME. The Multi-Matic Corporation, Van Nuys, Calif., manufacturers of Gen-A-Matic electric plants, centrifugal pumps and Super Hole-A-Matic earth boring machines, has changed company name to Gen-A-Matic Corp.

LOVEJOY APPOINTED ASSISTANT SALES MANAGER. David B. Lovejoy has been appointed assistant sales manager of the Construction Machinery Division of Chain Belt Co., Milwaukee, Wis. He has been with the company for 8 years; his last position being production manager of the Construction Machinery Division.

CHAIN BELT EXTENDS DISTRIBUTOR'S TERRITORY. Chain Belt Co., Milwaukee, Wis., has announced that the Spreitzer, Inc. will sell and service Rex construction machinery and equipment in an area to the west of their former territory. This territorial addition includes the Iowa counties of Dubuque, Jackson, Clinton, Scott, Muscatine, Louisa, Des Moines and Lee. The company also has announced that Eighmy Equipment Co. will now sell and service Rex construction machinery in an additional area to the west of their former territory. This territorial addition includes the Illinois counties of Joe Daviess, Carroll, Whiteside, Rock Island, Mercer, Warren, Henderson, Hancock, Henry, Knox, and McDonough.

PARTS DEPARTMENT FOR JAHN TRAILERS. Transport Trailers, Inc., Cedar Rapids, Iowa, has established a complete parts and service department for all Jahn trailers formerly manufactured by C. R. Jahn Co., and the Jahn Trailer Division of Pressed Steel Car Co.

NEW MARION DISTRIBUTOR. Mort-Witthauer Equipment Co., 2518 University Ave., S.E., Minenapolis, Minn., has been appointed distributor by Marion Power Shovel Co., Marion, Ohio, for the state of Minnesota.

COSBY JOINS PRESSTITE. C. E. Cosby, formerly divisional sales manager of Mallinckod Chemical Works, has joined the staff of Presstite Engineering Co., St. Louis, Mo., as executive assistant to the vice-president in charge of sales.

JOY MFG. RELOCATES DETROIT OFFICE. The Detroit office of Joy Manufacturing Co., Pittsburgh, Pa., is now located at 17615 W. McNichols Road, Detroit 35. This office incorporates the new Joy Detroit warehouse. Stephen Lashenich, Jr., is representative in the Detroit area.

D-A LUBRICANT PROMOTES SPRATLIN. R. W. Spratlin has been appointed district representative for Oregon and Idaho for D-A Lubricant Co., Inc., Indianapolis, Ind., with headquarters at 1231 N. W. Hoyt T., Portland, Ore. He formerly covered Idaho for D-A Lubricant.

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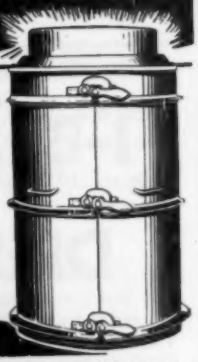

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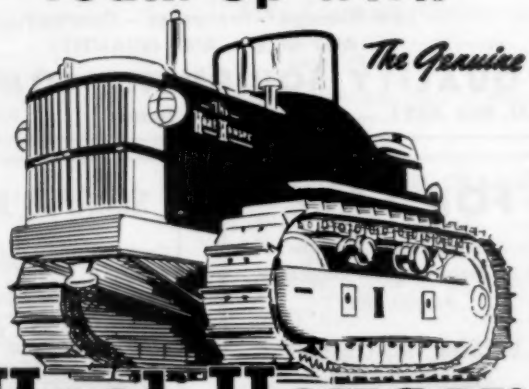

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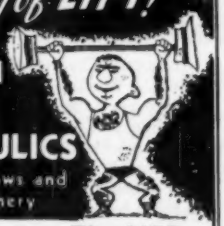
for Snow Plows and Road Machinery



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FITS ALL TRUCKS — is FAST and EASY to Install

Available for 6 or 12 Volt Systems

1000 lbs. pressure
1 gal. per minute volume

Fan Belt Models Also Available.

MONARCH ROAD MACHINERY CO.

. . . for more details circle 223, page 16

GARLINGHOUSE BROTHERS SELL RETAIL SALES DIVISION. Garlinghouse, Fremon & Co., a new corporation, has purchased the retail sales division of Garlinghouse Brothers. Located temporarily at the same address, 2415 East Washington Blvd., Los Angeles 21, Calif., they will continue to represent in Southern California all the nationally known heavy construction equipment manufacturers previously handled by Garlinghouse Brothers. Garlinghouse Brothers will devote their entire activity to the development and manufacture of Gar-Bro products by the Gar-Bro Manufacturing Co. of Los Angeles and Peoria, Ill., and by the Gar-Bro Wheel Co., of Los Angeles.

NEW BUCYRUS-ERIE DISTRIBUTOR. Syracuse Supply Co., 294 Ainsley Drive, Syracuse, N. Y., has been appointed distributor by Bucyrus-Erie Co., South Milwaukee, Wis. for its excavators and cranes in the Central New York area. The territory covered by Syracuse Supply Co. extends through central New York from the Pennsylvania border north to the St. Lawrence River and includes the following counties: Clinton, Franklin, St. Lawrence, Jefferson, Lewis, Herkimer, Oswego, Oneida, Cayuga, Onondago, Madison, Tomkins, Cortland, Chenango, Otsego, Tioga, and Broome.

NEW DISTRIBUTOR FOR PIONEER. Finn Machinery Co., 1342 W. Church St., Orlando, Fla., has been named distributor of equipment of Pioneer Engineering Works, Inc., Minenapolis, Minn., a subsidiary of Poor & Co., Chicago, Ill. Sales territory is the Florida counties east of and including Gadsden, Liberty and Franklin and north of and including Sarasota, DeSoto, Highlands, Osceola and Brevard.

ADVERTISING AGENCY FOR HERCULES GALION. Palm & Patterson, Inc., Cleveland, Ohio, have been named advertising agency for Hercules Steel Products Corporation and Central Ohio Steel Products Co. Elliott E. Smalley, former Central Ohio manager of advertising and sales promotion, will occupy the same position with the new company.

ZAHNISER PROMOTED BY GAR WOOD. Ralph W. Zahniser has been appointed manager of promotion and advertising for Gar Wood Industries, Inc., Wayne, Mich. He has been with the company since 1951 and has served in several capacities in sales promotion and advertising.

CHRYSLER HAS NEW REGIONAL OFFICE. Chrysler Corporation has established a regional sales office in Houston, Texas, for sale of Chrysler industrial and marine engines. D. D. Chene, former sales representative for the southwest area has been named regional manager of the new office.

CUMMINS APPOINTS STER REGIONAL MANAGER. Peter Ster, Jr., formerly regional service engineer, has been appointed regional manager for eastern Canada by Cummins Engine Co., Columbus, Ind. His headquarters are 321 Bloor St., East, Toronto, Ont.

Ask the man behind the gun . . .

White gives you everything you want in an engineer's transit

Shown, model 7014 with "A" standard. "U" type also available. $675.00* complete with tripod case and field equipment.

WHY are more and more engineers and builders choosing White Engineers' Transits? Basically, the reason is simple: White transits are designed and built for the man in the field. They incorporate all the work-saving, accuracy-boosting features . . . the rugged construction . . . the simplified quality components that you want. In addition, you get coated optics, covered leveling screws and internal focusing Telescope. Wide frame tripod is optional.

YOUR CHOICE OF THREE RETICLES AS SHOWN BELOW —

Fig. I Cross hair arrangement for our standard levels.

Fig. II Stadia hair arrangement for our standard transits.

Fig. III Special stadia hair arrangement, furnished upon request.

To get the details on the complete White line of instruments for Engineers, Surveyors and Builders, write for Bulletin 1053. DAVID WHITE COMPANY, 325W. Court Street, Milwaukee 12, Wisconsin.

DAVID WHITE COMPANY

We offer the most expert REPAIR SERVICE on all makes, all types of instruments

*Prices subject to hange without notice.

. . . for more details circle 238, page 16

Nice Comfortable Cab for the Shivering Operator

● Latest in bulldozer cabs, designed to help move more yardage in adverse weather, this enclosure has large glass areas for good visibility. With heater sometimes supplied, the operator can keep the chill off during winter and spring earthmoving, snow removal and other cold-weather operations. Photo courtesy Crenlo, Inc.

CUNNINGHAM OF ATLAS POWDER RETIRES. A. H. Cunningham, sales agent for Atlas Powder Co. at Los Angeles since 1943 and a member of the Los Angeles explosives sales force since 1918, retired November 1 under the company's pension plan.

HARMISON APPOINTED PARTS SALES MANAGER. J. D. Harmison is now manager, parts sales, for the Tractor Group, Allis-Chalmers Manufacturing Co., Milwaukee, Wis. He has been tractor sales manager, Farm Equipment Division, since October, 1952.

More Wheelbarrow POWER with Less MANPOWER

it's the WISCONSIN-POWERED **Moto-Bug**

Shown here are several units of a fleet of 12 MOTO-BUGS, handling concrete in hopper bodies on a 27½ million dollar bridge job near Boston. These "glorified power wheelbarrows", made by Kwik-Mix, Koehring Subsidiary, Port Washington, Wis., are powered by a Wisconsin Model AKN single-cylinder Heavy-Duty Air-Cooled Engine . . . *power to fit the job and the equipment.* The 10 cu. ft. hopper is interchangeable with a 1500 lb. platform or a 1000 lb. fork lift . . . versatility that takes the high costs and hard work out of material handling.

In addition to efficient AIR-COOLING at all temperatures ranging from extreme sub-zero to 140° F., Wisconsin Engine features include tapered roller main bearings, oil pump lubrication (a valuable safety feature), high tension rotary type OUTSIDE Magneto with Impulse Coupling for quick starts in any weather, and heavy-duty design and construction in all details.

You can't do better than to specify "Wisconsin Power" for *your* equipment . . . 12 models, 3 to 36 hp., single cylinder, 2- and V-type 4-cylinder.

WISCONSIN MOTOR CORPORATION

World's Largest Builders of Heavy-Duty Air-Cooled Engines

MILWAUKEE 46, WISCONSIN

. . . for more details circle 239, page 16

FUNK RETIRES AS PRESIDENT. William F. Funk, former president of LaCrosse Trailer Corporation, LaCrosse, Wis., has announced his semi-retirement, after 64 years of association with the business, which was founded 90 years ago by his father, Michael Funk. Newly appointed LaCrosse officers include: Francis J. Duffy, President (active with the company since 1929); David F. Hyde, Vice-President; Robert J. Funke, Secy.-Treas. William F. Funk, who celebrated his 85th birthday recently, will continue as Chairman of the LaCrosse Board.

ROAD SHOW PUBLICITY COMMITTEE APPOINTED. Harvey A. Scribner, President of Russell T. Gray, Inc., and Chairman of the Road Show Publicity Committee, has announced the following committee for handling the Road Show publicity: E. E. Weyeneth, Construction Methods & Equipment; D. V. Buttenheim, Contractors & Engineers; G. L. Anderson, Construction Bulletin; J. D. Bowler, Jr., Southwest Builder & Contractor; C. C. Stewart, Constructioneer; A. W. Lehman, Richard T. Brandt, Inc.; H. K. Kenyon, Andrews Agency; Don Fricker, The Heil Co.; M. B. Jaeger, Bucyrus-Erie Co.; Lloyd Rager, LeTourneau-Westinghouse Co.; Wm. A. Rundquist, Pioneer Engineering Works; J. M. Gates, The Galion Iron Works & Mfg. Co.; B. F. Miller, ARBA; R. L. Smith, ARBA Kenneth Lindsay, President of CIMA; Julien Steelman, Chairman of the Road Show Board; and Harold Hess, Executive Vice-President of the Construction Industry Manufacturers Association will serve as committee members ex-officio. The American Road Builders' Show will be held at the International Amphitheatre, Chicago, Ill. — Jan. 26 to Feb. 3, 1957.

GALION CONSTRUCTING NEW SALES DISPLAY BUILDING. Construction has been started on a modern sales display room building to meet the needs of the sales service and training program of The Galion Iron Works & Mfg. Co., Galion, Ohio. The one-story brick and limestone building will house the Galion advertising and sales promotion departments, and the sales and service schools. The building will be approximately 200 ft. by 100 ft. Units in the building include a 250-seat auditorium, classrooms, offices, clubrooms, kitchen, and a large display room for Galion's motor graders and rollers.

● New Galion Sales Display Building

CLARK APPOINTED SALES MANAGER. Harold C. Clark has been appointed sales manager, Findlay Division of Gar Wood Industries, Inc., Wayne, Mich. He will direct sales activities for the Buckeye line of ditchers and road building machinery, and Gar Wood power excavators and cranes. Clark has served in several sales management capacities at Gar Wood since he joined this firm in 1952.

FLINK CO. BUYS BAKER TRUCK SNOW PLOW. Flink Co., Streator, Ill., has purchased the Motor Truck Snow Plow Division of Baker Manufacturing Co., Springfield, Ill. from the Allis-Chalmers Manufacturing Co.

Manufacture of the complete line of snow plows will be continued under the Baker name at the Flink Co. plant in Streator. Present Baker distributors will be retained by the Flink Co.

CONRAD M. KELLEY, recently in charge of the Dallas district laboratory of the Texas Highway Department, has joined the staff of the National Lime Association. He will provide technical information and service to highway engineers on lime stabilization of road bases and sub-bases. This Association is composed of lime manufacturers located from coast to coast.

Since nearly a thousand miles of road equivalent has been constructed with either lime or lime-fly ash stabilized bases over the past ten years, the Association, through the employment of Mr. Kelley, will become actively engaged for the first time in this new field for lime on a nationwide basis. Mr. Kelley is peculiarly well qualified for this assignment since, as a highway engineer attached to the 4th Army Headquarters, he supervised actual construction and reconstruction of lime stabilized roads throughout military bases and camps in the southwestern states. More recently, since 1953, he has supervised laboratory testing of lime-soil mixtures with the Texas Highway Department in Dallas, in which district some highly successful lime stabilized roads have been constructed.

● *Future Meetings.* The 37th annual convention of the AGC will be held Feb. 13-16 in New York; the 1956 midyear board meeting at Milwaukee Sept. 17-19; and the 1957 convention at Washington, D.C., March 11-14.

All-year
outdoor playground
Seattle, Wash.
Make your headquarters at The Stewart Hotel—preferred by vacationists and businessmen alike. Convenient downtown location—near theaters, entertainment and all shopping, yet easily accessible to all of Seattle.
Finest food and service. Garage facilities. Radio in every room.
from $4 single
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The STEWART HOTEL

MASSAGLIA HOTELS
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California's World-famous Resort—250 rooms
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Hotel SENATOR
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CHARLES W. COLE, Manager

Hotel EL RANCHO & Bungalows
GALLUP, New Mexico
World's Largest Ranch House—200 rooms
MARTIN L. HANKS, Manager

Hotel PARK LANE
DENVER, COLORADO
Magnificent Rocky Mountain View—400 rooms
CHARLES W. COLE, Manager

Hotel RALEIGH
WASHINGTON, D. C.
On Famous Pennsylvania Ave.—500 rooms
JOHN F. SCHLOTTERBECK, Manager

Hotel BOND
HARTFORD, Conn.
Hartford's Finest—400 rooms
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CINCINNATI, Ohio
Hospitality at its Best—700 rooms
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Hotel SHERWYN
PITTSBURGH, Pennsylvania
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MURREL F. VAUGHN, Manager

World-famed hotels—
Teletype service—Family Plan

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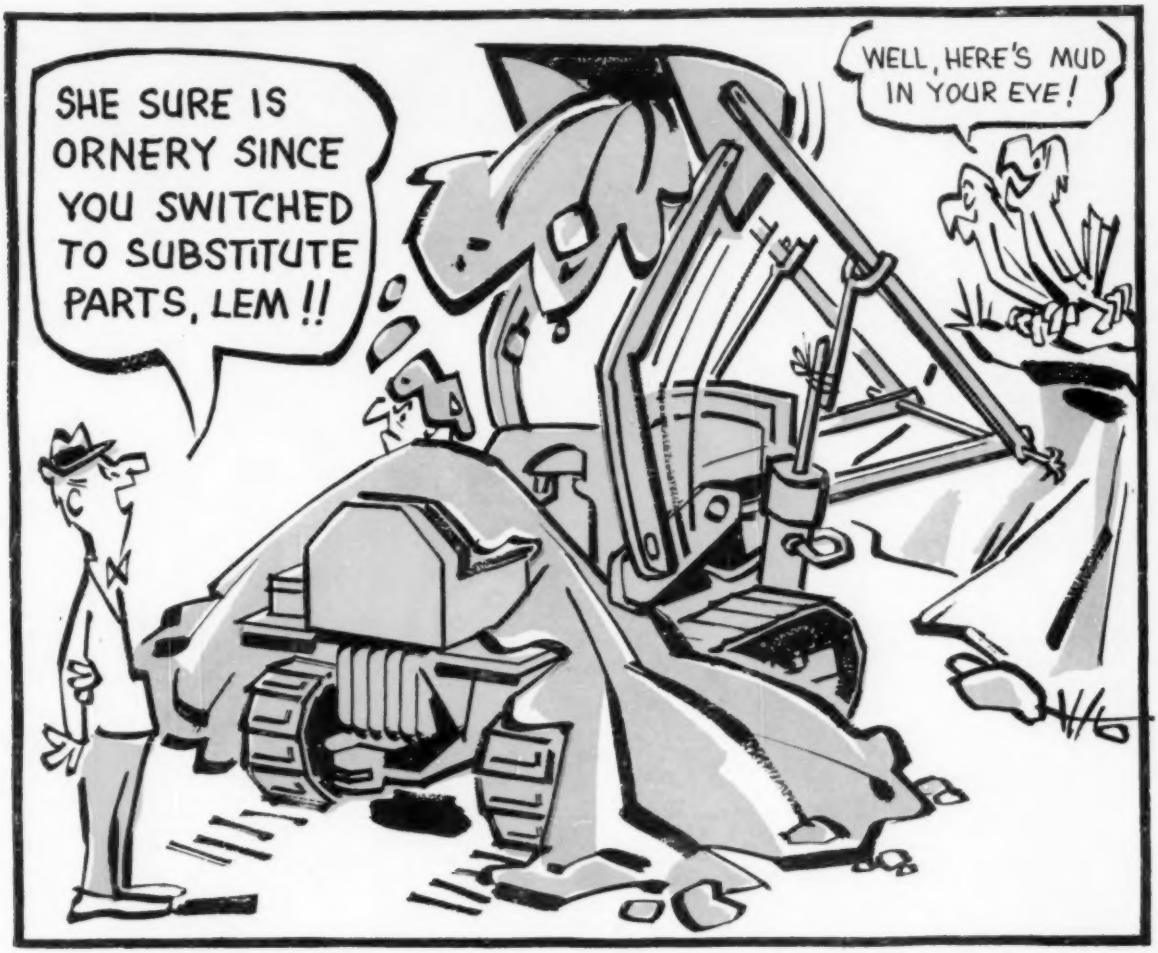

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Better get genuine Caterpillar parts every time.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CAT valves are made of special nickel-chromium alloy steel. Even at high operating temperatures, they resist distortion, corrosion and erosion.*

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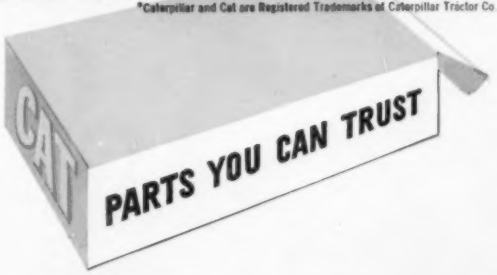

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Galion Allsteel dump bodies and hoists are quality-built to provide lengthy, dependable and economical service life. Here's proof:

Purchased in 1937, the Galion dump body shown above has been in continuous use ever since!

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